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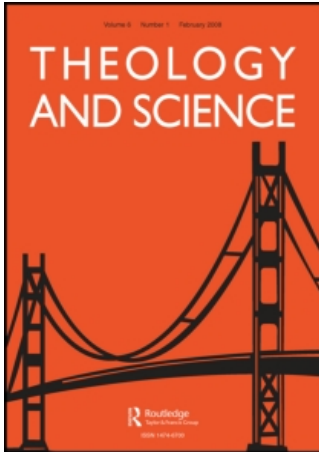
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The Divine Action Project, 1988–2003*

WESLEY J. WILDMAN

Abstract This article explores the state of the art in theories of special divine action by means of a study of the Divine Action Project (DAP) co-sponsored by the Vatican Observatory and the Center for Theology and the Natural Sciences in Berkeley. The basic aim is to introduce the DAP and to summarize its results, especially as these were compiled in the final “capstone” meeting of the DAP, and drawing on the published output of the project where possible. The subsidiary aim is to evaluate criticisms of theories of special divine action developed within the DAP.

Key words: Divine Action; Vatican Observatory; Center for Theology and the Natural Sciences; Laws of Nature; (Non)-interventionism; (In)compatibilism; Theodicy

Does God act to achieve special providential aims in the world? Sacred texts of many traditions speak of intentional divine action. Some people pray expecting God to respond and answer their prayers. Religious liturgies express confidence in God’s action in the past as well as God’s ability and willingness to intervene in response to present concerns. Over the centuries, religious scholars have advanced theories of divine action in order to give intellectual support to traditional claims about God’s special, intentional, purposeful action. What is the state of the art in contemporary theories of special divine action?

On the pessimistic side, the recent book *Divine Action and Modern Science* claims that contemporary theology is in a crisis.¹ Its author, Nicholas Saunders, believes that Christianity desperately needs a sound theoretical account of God’s action in the world if it is not to be swept away by demythologized secular worldviews with no need of the hypothesis of God’s special providential activity. Unfortunately, according to Saunders, no adequate theory of divine action yet exists, and this state of affairs threatens to be devastating for contemporary Christian theology, as well as for the faith and practice of Christian believers.

By contrast, far more optimistic conclusions are flowing from what I shall call the Divine Action Project (DAP). Divine action was the major theme of a wide-ranging series of conferences and publications on theology and science jointly sponsored by the Vatican Observatory and the Center for Theology and the Natural Sciences in Berkeley.² This research group culminated its work in a

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September 2003 “capstone conference” in Castel Gandolfo, near Rome, reflecting on its published output, identifying areas of agreement and disagreement. What I call the DAP refers to the work of this group as it bears on divine action. DAP participants have been trying to meet precisely what Saunders rates as Christian theology’s single most pressing need. The major points of consensus among DAP participants were that there are significant theoretical grounds for confidence in the intelligibility of the concept of providential divine action, and that there are several technically and theologically feasible theories of it.

What could account for these spectacularly divergent conclusions? Is this more evidence that theology is a “think anything, say anything” discipline, with no prospects for broad consensus or rational understanding? Alternatively, can we triangulate the disagreement and explain it? The basic aim of this article is to introduce the DAP and to summarize its results, especially as these were compiled in the capstone meeting, and drawing on the published output of the project where possible. This task consumes the bulk of the article. The subsidiary aim is to evaluate criticisms of the DAP. I shall not devote space to my own criticisms beyond what I say in the next paragraph. I shall argue that Saunders does not provide a compelling argument for his pessimistic conclusions and that his otherwise insightful criticisms of some DAP theories silently depend on an interpretation of laws of nature that those he criticizes reject. Furthermore, referring to the argument of German philosopher Immanuel Kant that it is impossible to demonstrate freedom in terms of categories of causation, I shall try to diagnose the peculiar challenges facing the DAP, to analyze how participants handled those pressures, and to show how Saunders’ criticism fits into this wider pattern. This attempt to explain the divergence of perspectives hopefully will extend the circle of consensus as far as possible and clarify the irreducible disagreements that remain.

I need to lay my cards on the table, particularly since credibility can be an issue both in summarizing complex projects and in addressing their critics. I have been involved in the DAP as one of the specialists in theology and science, contributing to volumes 2, 3, and 4. Unlike most other participants, I hold that the postulate of intentional divine action exacerbates the problem of theodicy to such a degree that we are justified in rejecting it for moral and theological reasons. This is the view of British theologian Maurice Wiles, also.³ Although my view of God differs slightly from that of Wiles, I do concur with his judgment that the idea of intentional, discrete divine acts is incredible, no matter how much some strains of Christian piety and large tracts of the Vedas, the Bible, and the Qur’an take it for granted. I approach Saunders’ book as a sympathetic and curious reader.⁴ After all, if the argument of that book is sound, then (presumably against Saunders’ intentions) I could venture to add incoherence of the concept of intentional divine action to the existing charge of moral repugnance. Likewise, though I participated in the DAP as one finally unconvinced about the reality of intentional divine action because of the problem of theodicy and the incredibility of discrete divine acts, I am persuaded that the DAP has succeeded in demonstrating the coherence and technical feasibility of several theories of intentional divine action. It is fundamentally the view of God underlying the main proposals emerging from the DAP with

which I disagree, therefore, rather than the proposed theories of divine action themselves.

Introduction to the Divine Action Project

In the late 1980s, Robert Russell of the Center for Theology and the Natural Sciences (CTNS) in Berkeley and George Coyne, S. J. of the Vatican Observatory (VO), in discussions with Nancey Murphy and William Stoeger, S. J., discerned a need for research on the topic of God's action in the world. Rightly noticing that the question of divine action is one of the theological issues that most directly presupposes facts about the natural world and its governing laws, they reasoned that evaluating theories of divine action in relation to our best knowledge of the natural world was very likely to be fruitful. What would be the fruit of such a discussion? If it were done well, they supposed, it could produce confirmation or disconfirmation of certain theories, the development of new proposals for divine action, and at the very least, a state-of-the-art survey of credible options. Such a survey might even make clear the theological presuppositions that would lead a thoughtful religious intellectual to affirm one theory of divine action over another. These were high hopes so their fulfillment would require a great deal of work and a well-designed process. Together, CTNS and the VO devised a method for the discussions. In this way—and the details are more fascinating than this compact summary can hope to suggest—the DAP was born.

Most people involved in the DAP had been involved in science-religion dialogues enough to know how perilous any work plan would be. Here is a short list of challenges with associated implications for the project. First, theologians typically do not know enough science to do what was proposed so expert scientists would be needed. Second, scientists typically do not appreciate the nuances of theology well enough to have much patience for a theologically focused project so the design would have to involve education of the scientists as much as education of the theologians. Third, many scientific perspectives are relevant to divine action and scientists typically are expert in only one area of science so confusion might reign unless the conferences focus on one area of science at a time. Fourth, a relatively small core of people would have to be involved in all conferences to guarantee some continuity of thinking and this small group would have to be expanded with experts who could cover the specific theme of each conference adequately. Fifth, divine action is a broad topic and a focused discussion that can engage the sciences seriously would require the additional constraint that the target will be divine action in conformity with natural laws. Sixth, the world religions are so diverse in their views of Ultimate Reality that a focused discussion would be most likely if the religious thinkers were limited to experts in Christianity. Seventh, and finally, the phenomenon of scientists and theologians talking past one another and utterly failing to engage the issue at hand is unpleasantly common in science and religion dialogue. It occurs in other interdisciplinary work, also. The method of procedure would have to involve intense interaction and a commitment on the part of project members to

engage one another and to do the difficult work of learning new perspectives. It would also be vital to involve scholars such as Ian Barbour, Arthur Peacocke, John Polkinghorne, Bob Russell, and Bill Stoeger who had professional competence in both theology and science.

The outcome of these considerations was an intensive workgroup-style method with some unusual features. The series of conferences was united by the theme "Scientific Perspectives on Divine Action" and each conference in the series focused on a specific scientific topic: quantum cosmology and the laws of nature, chaos and complexity, biological evolution, cognitive neuroscience, and quantum mechanics. For each conference, the organizing committee asked a new group of scientists and philosophers expert in the assigned topic to team up with the more or less unvarying group of philosophically minded theologians. Once the entire group was identified, the organizing committee distributed a packet of key readings that everyone in the group was expected to know, thereby establishing a baseline level of shared knowledge. Once these were digested, a number of "pre-conferences" were held to discuss the topic in smaller groups and to formulate ideas for research papers. These pre-conferences were local affairs, usually one somewhere in Europe and one somewhere in the United States.

Subsequently, those wanting to write a paper produced a draft and submitted it to the organizers. Here is where the genius of the method becomes evident. Organizers distributed these drafts to everyone involved in the working group and expected everyone to make written responses, which were in due course distributed to everyone. In this way, everyone together was involved in a rich discussion about the salient issues before the main conference even began. A second round of papers—some revisions, some new—were written and broadcast, followed by the second round of responses, once again with everyone reading all of the responses. Eventually those writing produced a definitive conference draft of their papers, suitably revised in light of the comments received, and these drafts were distributed and read in advance of the conference. This intense method of proceeding optimizes engagement with the issue under discussion and minimizes the problem of "parallel play" pseudo-dialogue.

At each main conference, where the entire group gathered for the first time, there was the refreshing policy of not reading any papers. Since all had been distributed and read prior to the conference, the author merely made a few introductory remarks, usually bearing on motivation or newly developed ideas, and then the group launched into vigorous discussion for ninety minutes or so. It was draining work but also work of the most intellectually rewarding sort. Some sessions in the conference were given over to relatively unstructured discussion of the main theme. After each conference, people rewrote their papers in light of the conference discussion and submitted the final draft to the editors of the conference volume. If the paper was accepted for publication in the volume, then the editorial suggestions were incorporated in yet one more round of revisions. The whole process, from beginning to end, took at least two years for each volume.

Nothing less than this intense working style can ever really come to grips with the complexity of a problem with such obvious interdisciplinary dimensions. This conference series was one of only two I have been involved in that

produced a cautious yet real sense of making progress on a research topic.⁵ There are many sorts of conferences, of course, and not all have a research agenda. Time after time, however, conferences with a research agenda underestimate the difficulty of the task or attempt to spare participants from investing a lot of energy in the project, with the result that no progress is made. It is to the credit of the DAP organizers that they designed a procedure capable of supporting their research agenda.

Within the core group, the organizers included at various times process theologians (Ian Barbour, Charles Birch, Jack Haught), more-or-less Neoplatonists (Janet Soskice, Keith Ward, and myself), and more-or-less Thomists (George Coyne, Denis Edwards, Stephen Happel, Michael Heller, Bill Stoeger) of various stripes to challenge and complicate the dominant view of more-or-less personalist theism and panentheism (Bill Alston, Philip Clayton, George Ellis, Philip Hefner, Jürgen Moltmann, Nancey Murphy, Arthur Peacocke, Ted Peters, John Polkinghorne, Bob Russell, Tom Tracy). This complication arises mostly from within the sphere of advocacy of intentional divine action. However, the organizers also included philosophers and theologians who do not advocate intentional divine action, such as Willem Drees and myself, to challenge the project's overall coherence. Of course, this list of names does not include the many historians of science, philosophers of science, and scientists who were involved at one time or another or the new theologians and philosophers present at the capstone conference.⁶

Other methodological decisions were equally important for success. The organizers framed the project within the science-religion dialogue to make the discussion more precise and to fulfill the conditions for detecting and understanding divergence among the views of participants. They conceived of a technical readership for the DAP volumes, thereby rejecting any tendencies toward oversimplification. They concentrated on tractable issues rather than spectacular ones, which temporarily de-emphasizes traditional Christian themes such as the resurrection or miracles for the sake of allowing the project to move forward efficiently in other areas. They encouraged parallel research agendas within the one overall project, as we shall see later. They steered away from practical ethics to avoid direct discussion of divisive moral questions that might diffuse the focus of research. In addition, as noted above, they kept the theological focus on Christianity so as not to complicate the project with an interreligious dialogue agenda, and they focused mainly on personalist theism and panentheism, because it is with these ideas of God that traction with the natural sciences is strongest. Each of these organizing decisions limited the project and it is not difficult to imagine (indeed, I have heard) complaints about these limitations. I think the decisions made were good ones because without the precious commodities of focus and efficiency, no advance would be possible.

The fruit of these labors was of several kinds. The DAP succeeded in stabilizing terminology that is key for understanding theories of divine action. It demonstrated the usefulness of certain strategies for inquiry. It generated a comprehensive classification of alternative theories of divine action. It diagnosed the way that theological and philosophical instincts and convictions affect debates over divine action, and it generated a number of credible theories of intentional divine action.

Stated quickly like this, this list of accomplishments may seem rather modest. As I hope the details will show, however, these are remarkable achievements in a theological climate marked by stormy disagreements over everything from legitimate strategies to acceptable conclusions. In what follows, I shall outline the most relevant and important details of these conclusions, drawing especially on discussions and papers from the capstone conference.

Results: stabilizing terminology for discussion

Whenever a group of scholars can agree on terminological distinctions, they greatly improve the chances of advancing their research project and understanding disagreements among themselves. Sadly, this degree of clarity and terminological consensus is rare within theology and the humanities. I take these relatively stable distinctions also to be of great significance for the wider debate over divine action. I will refer to them freely in what follows, so I lay them out here. Grasping these distinctions is the most efficient way both to get into the mindset of DAP participants and to frame the state-of-the-art options within the contemporary discussion of divine action in the science-religion dialogue context.

One crucial issue affecting many terminological distinctions is the status of language about divine action. How literally can we treat the theological terminology we use? If we accept the traditional assumption that all language about God is analogical or metaphorical, then how can we render terms such as “divine act” or “divine intention” in the precise ways needed to make sense of the debates over feasibility of theoretical proposals for SDA? It does seem clear that the DAP and theologians more generally treat language about God as having degrees of literalness, so that we can judge certain metaphorical or analogical statements to be closer to the truth of the matter, and others to be further from the mark. The issue of degrees of literalness of theological language, however, continues to be a difficult problem within theology. This is due fundamentally to the instability of any standard we might invoke to assess literalness or accuracy of conceptual formulation. If we wish to speak literally about God forming intentions to act, for example, the theological schema that makes sense of divine intentions will be subject to questions about literalness.⁷ These questions in turn call for a metaphysical vision that is capable of stabilizing a theological schema of the divine nature. Now our metaphysical theory is setting conditions on what can count as a viable portrayal of God, whereas arguably it should be the other way around. The resulting choice seems to be between vicious regress and vicious circularity. The specter of theologians vainly fumbling after stable theological terminology has stirred mystical theologians (among whom I count myself) for centuries. It has also been one inspiration for the aggressive attacks on the so-called ontotheological tradition in recent decades. However, if we turn to poetic indirection instead of metaphysics, we face other problems, including the fact that poetic play is itself parasitic upon already existing terminology and symbols, which liturgical practices and metaphysical theology stabilize. Several DAP participants urged greater

consciousness of such problems upon the group,⁸ though discussions seemed to proceed without satisfying resolutions. For now, we must simply assume that we can speak with “some degree” of literalness about features of the divine nature needed to make sense of the terms of the debate over divine action. With that in mind, we turn to the key terminological distinctions.

First, the DAP concluded that the distinction between general and special divine action is important but that theologians draw it differently depending on their particular interests. This occurs because there is considerable entanglement of the general and the special in such concepts as continuous creation, divine sustaining of reality, and ubiquitous intentional divine action. Thus, we must stabilize these terms by stipulation, and this causes no confusion providing that we are clear about which way of distinguishing the terms we are using. One common path not taken here is to say that general divine action refers to the act of creation itself together with divine acts that occur at every place and time within created reality, whereas special divine action refers to acts that have effects in some places and times but not others. This way of drawing the distinction is useful for keeping the focus on one-time, one-place special divine acts but does not easily comprehend a number of views affirming universal special divine action (most clearly Murphy’s). It also obscures relevant questions about the divine nature. For the purposes of this paper, therefore, I will draw the distinction differently, in terms of presuppositions about God’s character, as follows:

1. General divine action (GDA) is the creation and sustaining of all reality in so far as this does not necessarily presume any specific providential divine intentions or purposes.⁹
2. Special divine action (SDA) is specific providential acts, envisaged, intended, and somehow brought about in this world by God, possibly at particular times and places but possibly also at all times and places.

This way of drawing the distinction captures the conclusions of the DAP more effectively than the alternative.

Second, over the years DAP members became increasingly aware of the variety of ways in which theological theories can relate to the natural sciences. Russell has presented a rich view of these relations in an elaborate diagram, which serves to underline how internally complex each of theology and science are, and thus, how rich the mutual interaction between them can be in principle.¹⁰ Within the DAP, two kinds of relation proved most important, both of which we called forms of “traction” between theology and science, a term suggested by Philip Clayton. By traction we mean formal and informal logical connections that yield both intelligibility and potential for correction and improvement.

1. Traction as consonance envisages theological assertions that are vague enough to be consistent with several competing scientific theories yet elaborated in such a way as to register and resonate with large areas of scientific theory.
2. Traction as consistency envisages theological propositions so specific that they can conflict directly with scientific assertions.

These two kinds of traction correspond to two kinds of sub-projects within the DAP that coexisted more-or-less happily, though not always without confusion and misunderstanding, especially in the early years of the project. The DAP was strongly committed to maximizing traction in the different ways that each sub-project demands, because traction increases the credibility of theological proposals.

Third, the DAP project tried to be sensitive to issues of theological consistency. For example, the idea of God sustaining nature and its law-like regularities with one hand while miraculously intervening, abrogating, or ignoring those regularities with the other hand struck most members as dangerously close to outright contradiction. Most participants certainly felt that God would not create an orderly world in which it was impossible for the creator to act without violating the created structures of order. This widely shared conviction led the main line of the DAP's research efforts to seek an account of SDA that was in accord with created structures of nature, which underlies the following key distinction. A noninterventionist special divine act is in accord with created structures of order and regularity within nature, while an interventionist special divine act involves abrogating, suspending, or ignoring created structures of order and regularity within nature.

Some DAP participants were content to imagine that SDA is usually noninterventionist but on rare and providentially portentous occasions, such as the resurrection of Jesus Christ perhaps, or the consummation of the universe, God could act in interventionist fashion. Others entertained noninterventionist or "more than interventionist" readings of such events. For instance, Russell wondered whether we could interpret the incarnation and resurrection of Jesus Christ not so much as God violating existing regularities of nature but as God transforming those underlying regularities so that a new reality can emerge out of the existing one.¹¹ Still others such as myself, when entertaining this issue in the (to me) alien terms of personalist theism, thought the inconsistency of miraculous interventionism a small thing, and estimated the theological hubris of confining God to noninterventionist action a greater danger. Despite these differences, there was agreement that accounts of SDA as noninterventionist enjoy the greatest traction with the natural sciences, in the sense of consistency, because they allow scientific accounts of natural regularities to constrain what is possible in theological assertions about SDA.

Fourth, there was consensus among DAP participants that miracles received insufficient attention in the course of the project. This was due to the theological interest in noninterventionist theories of SDA and the methodological interest in maximizing traction between theology and the natural sciences. Nevertheless, we did discuss the idea of miracle from time to time. Ward offered the richest set of distinctions among ideas of miracle, as follows:

1. Miracles might be suspension or abrogation of nature's law-like regularities.
2. Miracles might be ways of speaking of apparently providential events that strike us as important and surprising.
3. Miracles might be the activation of latent features of natural objects that do not

show up within the theoretical framework of our existing natural sciences. For example, theopoiesis (theosis or divinization) might be a natural but latent feature of human beings that God can activate despite the fact that our science knows nothing of this possibility, and perhaps never could recognize it.¹²

The first sense of miracle as suspension or abrogation of nature's law-like regularities is precisely as clear as the reigning view of those regularities themselves (the same is true of the concept of intervention), which in turn directs our attention to laws of nature, to which we will come in a moment.

Fifth, related to the various interpretations of miracles, the DAP experimented with several distinctions bearing on the epistemology of situations in which a divine act is noticed or not noticed as such. The published distinction between divine acts that are apparent with (or without) religious presuppositions¹³ finally proved less compelling than Tracy's three-fold distinction among special divine acts as: objectively significant, causally (but not objectively) significant, and subjectively (but neither objectively nor causally) significant. In the sense of this distinction, objective special divine actions have a counterfactual logical structure: if God had not acted then nothing significant would have occurred. Subjective divine actions have a similarly crisp meaning: they have to do with perceptions only and presume nothing at all about God. The middle position is trickier but still needed because of the logical possibility that some events may have special providential significance even when God does not act specially to cause them. This providential significance might even be anticipated by God (if a suitable interpretation of divine knowledge is in place) and yet not intentionally caused.

Sixth, the DAP adapted to its own purposes the distinction between compatibilism and incompatibilism that has proved useful in the context of philosophical debates over human freedom in the world. Wegter-McNelly furnished the most comprehensive view of the potential for this distinction by noticing three variants:

1. Anthro-physical (in)compatibilism asserts that human freedom is (in)compatible with physical determinism.
2. Anthro-theological (in)compatibilism asserts that human freedom is (in)compatible with divine determinism.
3. Theo-physical (in)compatibilism asserts that divine freedom is (in)compatible with physical determinism.

Determinism here means that, given that the world is a particular way at one moment, its unfolding thereafter is fixed and inflexible. In the case that this inflexibility is due to the laws of nature, we would be speaking of physical determinism. When it is due to God's action or God's will or perhaps even God's knowledge, then we would be speaking of divine determinism. Philosophical writings on determinism are filled with subtleties but this definition will serve my purposes here.

Each of the three ways of distinguishing between compatibilism and incompatibilism has its own characteristic debates and a wealth of literature. The third—theo-physical—was the main concern of the DAP. In this context, now dropping

the qualification “theo-physical,” we used the distinction in the following way: Incompatibilism assumes that physical determinism entails the impossibility of non-interventionist SDA (equivalent to $\text{NISDA} \rightarrow \sim \text{PD}$); and compatibilism assumes that non-interventionist SDA is consistent with either physical determinism or physical indeterminism (equivalent to $\text{NISDA} \rightarrow \text{PD}$ or $\sim \text{PD}$).

Incompatibilists adopt the strategy of showing that the physical world is indeterministic, because this is a necessary condition for non-interventionist SDA. This leads to strong interest in gaps, especially uncloseable gaps, in the world’s causal nexus. By contrast, compatibilists have nothing to gain by demonstrating or assuming physical indeterminism. Because compatibilist theories of SDA remain untouched by debates over physical determinism, their proponents have no need to locate uncloseable gaps in the world’s causal nexus. This strategic difference was evident throughout the DAP. In fact, there is a tight correlation between these strategies and the types of traction defined above. Incompatibilist proposals seek traction as consistency, which is to say they achieve intelligibility by exposing theological propositions about SDA to direct potential contradiction by physical propositions about the world’s causal nexus of events. By contrast, compatibilist proposals seek traction as consonance, which is to say that their theological propositions about SDA are immune from direct conflict with physical propositions about the world’s causal nexus of events but can still achieve intelligibility by richly registering the scientific portrayal of physical reality.¹⁴

Seventh, the DAP hosted a variety of approaches to developing incompatibilist theories of SDA (these are the theories that have something to gain by locating causal openness in physical reality). One strategic disagreement expresses different appraisals of the near certainty that our current scientific descriptions of the structures and regularities of nature are only approximations. The disagreement is as follows: an adequate incompatibilist theory of SDA should seek causal openness in nature not only as described in existing physics but also as intimated by the incompleteness and provisional character of current science; or, an adequate incompatibilist theory of SDA should seek causal openness in nature only as described by existing physics. Theories of SDA following the first approach (represented especially by Polkinghorne) accept a short-term reduction in concrete intelligibility by entertaining speculative future physics, in exchange for greater long-term robustness in the face of anticipated changes in the scientific portrayal of nature. Theories of SDA following the second approach maximize the concrete intelligibility of the theological theory in the short term by focusing solely on existing physics while leaving the theological theory more vulnerable to falsification by future changes in science. Thus, this strategic distinction expresses different ways of balancing two theoretical virtues that are desirable in a theological theory: short-term concrete intelligibility through dealing only with existing science and steering away from speculative physics, versus long-term robustness in the face of ever-changing scientific portrayals of the world’s causal nexus.

Eighth, the DAP generated a strong consensus around distinctions pertaining to interpretation of the laws of nature. The basic distinction is between the following:

1. The laws of nature have descriptive status only; they refer to regularities and patterns that we discern in natural objects, relationships, events, and processes.
2. The laws of nature have ontological status; they refer to ontologically independent principles to which natural objects, relationships, events, and processes are subject.

There are a number of ways to picture the mode of existence of principles to which natural objects, relationships, events, and processes are subject on an ontological interpretation of the laws of nature. Such principles may exist independently of nature yet be known through the study of nature, they may exist independently of nature and be rationally intuited without empirical observation, or they may be vested in nature as deep formal or structural principles. The distinction here is so framed that we can safely bracket these questions of ontology. The key point is that exclusively descriptive approaches to the laws of nature deny that these laws refer to existent principles.¹⁵ In the case of stochastic or probabilistic laws, this second possibility is ambiguous. This leads to a finer, three-fold distinction for stochastic laws, as follows:

1. Stochastic laws of nature have descriptive status only (as above).
2. Stochastic laws of nature have ontological status in the sense of referring to principles or deep structures of nature that statistically govern large ensembles of events but not each individual event within an ensemble of events.
3. Stochastic laws of nature have strong ontological status, in the sense of referring to principles or deep structures of nature that statistically govern each individual event within an ensemble of events.

While there are many perspectives on laws of nature in the philosophy of science literature, the DAP consensus was that the distinctions above capture the features of those wider debates that are relevant for evaluating theories of SDA. Some participants argued that the strong-ontological interpretation of stochastic laws was incoherent, and it is certainly true that no theory of SDA proposed within the DAP makes use of it. Yet it is important to acknowledge that this view of stochastic laws exists. In fact, it is one reason¹⁶ for the widespread intuition that quantum-level SDA must be interventionist, violating the probabilities that constrain quantum measurement events. This view appears in criticisms of proposals for quantum level SDA both within the DAP and beyond.

Finally, with regard to the divine nature, the DAP predictably found itself grappling with the perennial question of the distinctions among personalist theism, classical theism, and panentheism. These words are used in so many ways that they can only be stabilized by stipulation, and even then, any stipulation begs a horde of detailed questions. Nevertheless, for the sake of maximizing clarity in an inevitably murky situation, I present here the working set of distinctions that guided DAP terminology. First, assume that we can stabilize the distinction between God as complete without the creation and God as incomplete without the creation. Further, assume that we can make out a distinction between God being changed by the world and God remaining unchanged. Then, while these are by no

Table 1 Types of Theism

	God can be changed by the world	God remains unchanged by the world
God is complete without the creation	Personalist theism	Classical theism
God is incomplete without the creation	Panentheism	

means simple assumptions, they do allow for a grid of positions, as shown in Table 1.

Note that the empty position on the grid has representatives, though not within the DAP. For example, Robert Neville's view of *creatio ex nihilo*, an intensification of John Duns Scotus's stress on the primacy of the divine will over the divine nature, has "God" determining both the world's nature and the divine nature in the primordial creative act. Thus, God has no nature apart from creation and so, in that sense, is incomplete (in fact, is nothing) without it. Neville belongs in the empty square, accordingly.¹⁷ Note, also, that these distinctions assign a tightly constrained definition to panentheism. In its more literal sense, it affirms simply that all of reality is in God, by contrast with pantheism, which literally means that everything is God. Yet the narrower construal of panentheism introduced here is not an unusual usage in our time.

Results: classification of options

The positions advocated within the DAP can be summarized at two levels. First, taking the widest possible view, we can picture each position within the project, as well as positions not represented within the project, as making a series of key decisions that characterize the outcome. We can represent the outcome of analysis at this level as a decision tree, one version of which is supplied in Appendix A. This view of matters is helpful for placing the main focus of the project—on personalist theism and panentheism—in a wider context that is sensitive to issues of broad concern in comparative theology.

Second, we can tighten the focus onto the major proposals of the DAP and characterize them using the distinctions introduced above. The result is a different kind of diagram (Table 2) containing the views that I will discuss in more detail below. Table 2 also includes several actual or hypothetical critics of the major views defended within the project—Saunders, Wiles, and Neville—with their names in parentheses.

The major result of the DAP is simply that all of the views of objective SDA defended by participants are feasible and coherent in most respects. This is not the happy agreement it might seem on the surface. A number of participants, including me, reject the entire concept of SDA as morally intolerable, though not thereby unintelligible. There are also fierce disagreements about whether compatibilist or incompatibilist approaches are more promising, whether individual

Table 2 Views of Special Divine Action (SDA)

Characteristics of Views	Non-objective		Objective				
			Compatibilist		Incompatibilist		
Holders of Views	Davies	Clayton	Laws of Nature as:			Laws of Nature as:	
	Drees	Peacocke	Approximate	Descriptive	Ontological	Strong-ontological	
	Wildman (Neville)	Soskice	Polkinghorne	Murphy Russell	Ellis Tracy	(Noone within DAP)	(Saunders)
	(Wiles)	Stoeger Ward					
Non-interventionist	N/A	Yes	Yes	Yes	Yes	No	Yes
Notes	These views seek traction with the natural sciences through consonance and richly registering scientific details rather than through direct consistency constraints		This view is effectively compatibilist but can invite causal joint proposals	Universal SDA; divergence on whether God plays a constitutive role in events	SDA occurs only in some events and God plays a constitutive role in none	Tracy does explore this view as a thought experiment (miracles)	This is the view that Saunders seems to want to achieve

views are framed in the optimal way, and whether a strong-ontological interpretation of stochastic laws of nature is possible and desirable. Through all of these and other disagreements, the consensus is that we can give several theologically feasible and scientifically coherent accounts of God's action in the world. The details have proved fascinating, however, so I now turn to a discussion of general trends and particular positions.

Views on the left side of the diagram enjoy the least traction (in the sense of direct consistency constraints) with the natural sciences, whereas traction of this sort increases as we move rightwards through the columns. Indeed, the non-objective (i.e. merely causally or subjectively significant) views and the compatibilist views seek traction of the other sort, as consonance with the natural sciences. There is an issue of taste or rational style here and it is fair to ask about why people diverge on such issues. I think two competing theological instincts are at play and understanding them can illumine the divergent judgments about the best type of traction to seek.

One instinct is to seek *concrete intelligibility of theological assertions*, which drives theories of divine action toward incompatibilist, non-interventionist approaches, discourages speculation regarding future science, and encourages theological speculation to maximize intelligibility-yielding traction between theology and science. Another instinct is to demonstrate *credibility of basic faith claims*, which drives theories of divine action to seek long-term stability by avoiding over-commitment to existing science, and to limit theological speculation to the minimum needed to establish the rational feasibility of faith claims, resisting further speculation so as to avoid tying Christian claims too closely to unduly specific, credibility-stretching hypothetical proposals.

If concrete intelligibility were the only worthy goal of a theory of divine action, then everyone would crowd towards the right side of the diagram. With the concern for credibility and the associated worries about the destabilizing effects of undue speculation thrown into the mix, however, there is an impulse to move toward the left side of the diagram. Balancing these two theological virtues is a matter of art and each DAP participant found his or her own distinctive way to do that.

Compatibilist theories of SDA

Compatibilist views within the DAP were of several kinds. Clayton and Peacocke articulate versions of panentheism and seek to articulate special divine action in such a way as to register contemporary scientific discussions of the evolutionary emergence of complex systems, including especially the realms of life and mind, from earlier and simpler forms of organization in our universe. The idea of emergence provokes complex debates about ontological levels, causal powers and forces, and supervenience relations, as well as causation of the whole-part and top-down kinds that we might make plausible in the natural sphere to as to stabilize analogies for accounts of SDA. Soskice, Stoeger, and Ward defend variations of classical theism, in rather neo-Platonist, rather neo-Thomist, and rather

theopoietic forms, respectively. Thus, they all presume the distinction between the secondary causes of natural objects or processes and God as the primary cause of all events in nature, lying behind and supporting the efficacy of secondary causes. These views are compatibilist because there is no difficulty imagining God acting freely and noninterventionistically in nature regardless of how causally closed the scientific portrayal of nature is. Yet all think, on other grounds, that the world is ontologically indeterministic in important ways that make for meaningful human freedom and responsibility.

I will not venture to discuss the compatibilist proposals in any detail here, in part because their consonance with the natural sciences' portrayal of the complex process of biological evolution is difficult to evaluate conveniently and in part because they are still very much under development.¹⁸ However, it is important to note that the DAP became a forum for complex and penetrating debates over the ideas of top-down causation and whole-part constraint, and that there remains fairly significant disagreement over precisely how best to understand these terms. This lack of consensus directly correlates with the proliferation of proposals for understanding complex biological systems in the wider literature. Other conferences and future research doubtless will lead to gains in clarity around these issues.

Incompatibilist theories of SDA and causation

The remainder of this review and analysis will focus on incompatibilist theories of SDA. At the outset, however, it is important to note that there is widespread debate (if not outright confusion) in the philosophy of science and in metaphysics over the nature of causation. This presents a serious difficulty to any incompatibilist theory of SDA because the very distinction between compatibilist and incompatibilist strategies depends on a concept of causation. In practice, this difficulty is less severe than it might seem at first, so long as we can grant that there is, *in some sense*, a workable concept of "ordinary causation" to which we can appeal in devising an incompatibilist theory of SDA. Bracketing philosophical debates over the precise meaning of ordinary causation in this way allows theological proposals to get started. They cannot travel very far before having to face two major disputes in the theory of causation that have direct consequences for a theory of SDA.

The first dispute concerns Alfred North Whitehead's proposal of the process model of causation.¹⁹ By making God's action one element in every event (in the technical sense of an actual occasion), Whitehead appears to solve the theological problem of SDA and the philosophical problem of causation simultaneously. So why, we must ask, has not everyone flocked to affirm Whitehead's view? While some theologians have done so, many others have not, primarily because Whitehead's view requires abandoning the conception of God as creator, proposing instead that God and the world are mutually codetermining, coeternal realities. Philosophers of science are unenthusiastic about Whitehead's proposal for causation because it appears unrelated to the natural sciences. Of course, Whitehead

intended this, deeming it desirable for a metaphysical theory to be consistent with any possible discovery of the sciences. For their part, however, most philosophers of science are more interested in detailed consonance and, where possible, direct consistency constraints between scientific theories and their proposals about causation. While some DAP participants accepted Whitehead's theory of causation (Birch, Barbour, and Haught), most did not, but everyone advancing an incompatibilist theory of SDA had to make this decision one way or another to select a specific causal context within which to frame the distinction between compatibilism and incompatibilism.

The second dispute concerns the feasibility of types of causation other than ordinary, low-level causation. If theoretical portrayals of top-down, whole-part or mind-to-mind causation correspond to genuine natural processes, then the meaning of an incompatibilist theory of SDA might be quite different than would be the case if ordinary, low-level causation were the only type operative. To illustrate this, suppose we conceive of top-down causes as ontologically distinct from ordinary causes organized in complex systems. Then we would be able to explain (in principle!) the top-down and bottom-up effects that we observe around us not in terms of the way complex systems constrain and marshal ordinary causes, but in terms of direct action from a higher level of nature to a lower level, without any need for ordinary causation at all. This, in turn, would open the speculative possibility of God being able to act at any level of nature using an analogous causal joint, one appropriate to God's top-down relation to the world. There would be no intervening in the laws of nature on this view because the divine mode of top-down causation would be as ontologically independent of our familiar laws of nature as are other forms of top-down causation (such as strong views of mental causation).

This might seem like a promising option for a theory of SDA but no DAP participant unambiguously embraced it. I think there are two main reasons for this. On the one hand, from the point of view of theoretical criteria for the adequacy of SDA proposals, the "concrete intelligibility" virtue mentioned above is not satisfied when we invoke a special causal joint that is not related to the ordinary laws of nature. Of course, this special God-world, top-down causal joint may have its own laws but they would lie outside the realm of the natural sciences. On the other hand, there may be no such thing in nature as top-down causation in this strong sense, as ontologically independent of ordinary causes marshaled in complex systems. If there is no such thing in nature, then there is no good reason to propose a special God-world, top-down causal joint, either, but how would we settle the question of the reality of top-down natural causes in the strong sense? This takes us back to the same debates over supervenience, emergence, and reductionism that show up in compatibilist theories of SDA, and I have already given my reasons for not surveying these here. It is enough to note that there was disagreement among DAP participants over the best way to explain the top-down, bottom-up, whole-part, and part-whole features of the behavior of complex systems and that no DAP participant advanced an incompatibilist view of SDA affirming top-down divine causation in this strong sense.²⁰

By contrast with the widespread disagreement over the status of top-down causation, the DAP enjoyed consensus on one issue regarding whole-part constraint, which I shall explain in what follows. Whole-part constraint describes an obvious feature of many complex systems whereby larger structures constrain the behavior of constituent parts. Of course, explanations for whole-part (as well as part-whole, top-down, and bottom-up) behaviors vary, as just described. It is clear that merely describing the behavior using the phrase “whole-part constraint” is not in itself an explanation of it. For a satisfying explanation, we have to turn to ordinary causation marshaled by complex systems, to top-down causes ontologically distinct from ordinary causes, or to something else. Similarly, in the context of incompatibilist theories of SDA, we must specify a causal joint for God’s action if we imagine it operating in the mode of whole-part constraint. Having agreed on this much, the DAP consensus ended. Perhaps God influences wholes (boundary conditions) through causal joints described in other SDA proposals, such as those to be discussed below. Perhaps it is through top-down causation in the strong sense discussed above. Perhaps it is through the primordial creative act itself. Alternatively, perhaps the incompatibilist approach of specifying causal joints is simply not the best way to go here, so that we can consider ourselves free to assert that God influences boundary conditions somehow, even if we cannot say how. Peacocke and Clayton appear to take this last, compatibilist path, which leads them to seek traction between their SDA proposals and the natural sciences not through direct constraints but through large-scale consonance.

The final dispute concerns direct mind-to-mind causation, which presumes a dualist account of human nature, whereby human beings have minds and souls somehow related yet not causally reducible to one another. Most DAP participants deny this dualist account of human nature. Ward has great sympathy for this view of human nature, however, and so is willing to entertain direct mind-to-mind causation as one possible mode of divine action.

Incompatibilist theories of SDA and chaos theory: Polkinghorne

As noted above, one of the major differences among the incompatibilist views represented in the DAP concerns how to deal with the inevitability that our current understanding of the laws and processes of nature will change in the future. Polkinghorne makes a virtue of this, treating current physical laws as approximations to a suppler, subtler underlying reality, within which God can act freely and noninterventionistically. He applies this approach especially to chaos theory, thought of as a physical as well as a mathematical theory.²¹ Polkinghorne further proposes that God can insert pure active information with no energy cost into physical systems thanks to the features of chaotic systems, especially the infinite closeness of trajectories within chaotic attractors. Then the sensitive dependence of chaos allows macroscopic effects to emerge from these low-level changes. Thus, God’s action is not about moving mass-energy so much as somehow prompting the emergence of new forms of organization.²²

This first part of this proposal—laws of nature as approximations—is perfectly intelligible, but there has been controversy about the kinds of arguments that might legitimately count for and against it.²³ In particular, critics have targeted the “realist” strategy by which Polkinghorne argues that epistemological limitations in chaos theory entail ontological openness in nature.²⁴ The epistemological limitations are well understood: they result from the eventual unpredictability of chaotic systems, which in turn is because of the way they repeatedly stretch-and-fold their input domains, produces extreme sensitivity to initial conditions.²⁵ Polkinghorne is committed to the program of critical realism, a commitment he says most scientists share, consciously or unconsciously.²⁶ This program seeks the “maximum correlation between epistemology and ontology. . . . Its motto is ‘epistemology models ontology’; the totality of what we can know is a reliable guide to what is the case.”²⁷ This instinct lies at the root of the ontological interpretation that most scientists attach to the epistemological limitation expressed in Heisenberg’s Uncertainty Principle and Polkinghorne argues that, “it is a rational and attractive option to pursue the same strategy in relation to other intrinsic unpredictabilities which we discover in nature.”²⁸ The epistemological limitations of chaos theory, therefore, “signal that ontologically much of the physical world is open and integrated in character.”²⁹

Polkinghorne’s critics typically are critical realists themselves in one way or another, so the fulcrum of this debate is not the epistemology-models-ontology maxim itself, but how it is applied. The eventual unpredictability of chaotic dynamical systems absolutely requires a deterministic environment (in the way that the mathematical environment is). It is impossible to take the epistemic limitations of chaos seriously without taking the deterministic framework equally seriously. Yet Polkinghorne detaches the underlying deterministic elements of chaos that his theory needs to explain eventual unpredictability from the ignorance forced on us by the eventual unpredictability of chaos itself. Then he applies his “epistemology follows ontology” strategy only to the ignorance part, despite the dependence of ignorance on determinism (again, in the sense that a mathematical chaotic system is deterministic).³⁰ Polkinghorne’s move seems inappropriately arbitrary to his critics within and beyond the DAP project, even while most agree that nothing blocks the central metaphysical hypothesis of Polkinghorne’s view that the laws of nature are approximations.³¹

The second part of Polkinghorne’s proposal concerns the causal joint of divine action. Polkinghorne’s use of the concept of active information presupposes the detailed continuance of mathematical chaos theory into the supple, subtle physical reality that he postulates beneath our current laws of nature. For example, both chaotic attractors and sensitive dependence need to exist in nature for Polkinghorne’s view to make sense. These are delicate features of purely deterministic mathematical systems that we have little reason to think could survive, and every reason to believe would vanish, in an indeterministic setting. Something extremely complex is going on in nature, of course, but it is unlikely to be chaos in any of its mathematical senses, all of which require very precise conditions only the controlled environment of mathematical dynamical systems seems suited to furnish. To put the point ironically, nature seems far too messy for chaos.

So far, I have defended the feasibility of Polkinghorne's main hypothesis about the laws of nature as approximations, and I have raised questions both about the arguments he advances to support this hypothesis, and about the proposed causal joint for divine action, but these difficulties may not be decisive and we do well to consider the matter more carefully.

For the sake of argument, therefore, let us grant Polkinghorne's hypothesis that laws of nature are downward emergent approximations to an indeterministic underlying reality. Furthermore, let us determine to use mathematical chaos as a conceptual model for describing this indeterministic ontology, including the causal joint of divine action. To pull this off despite the difficulties just described, we would have to commit ourselves to a dramatic revision of the basic ideas of chaos. The concepts of strange attractors, infinitely fine fractals, and sensitive dependence as we get them from mathematics would have to be rendered usable in an indeterministic physical environment that seems grainy at the level of the very small, and lacking the infinite fineness of mathematics. The most promising place to look for such a reformulation is in quantum chaos, which is why Polkinghorne rightly stresses the importance of quantum chaology for future thinking on this subject.³² Unfortunately, these basic concepts of chaos theory are so completely dependent on the determinism of mathematics that quantum chaos seems a vain hope to me; I think chaos in the strict sense is a mathematical abstraction not directly relevant to the physical world.³³ Nevertheless, there are enough open questions in quantum mechanics itself that hope remains for a new kind of chaos theory.³⁴

Alternatively, if we do not want to wait to see if quantum chaology proves successful, perhaps we could try to find ways to loosen the basic dependence of our proposal on mathematical determinism. For instance, because it is impossible in principle to show that chaotic attractors do not occur in nature, we might just continue to assert the thesis that chaos does occur in nature despite the fact that it seems so improbable and we do not yet have the sort of chaos theory that helps us make sense of such a claim. Or we might find a way to accommodate the likelihood that chaos does not occur in nature, perhaps by abandoning the concept of active information in chaotic attractors as an energy-free way for God to intervene, or perhaps by applying the concept of active information more vaguely to the world of nature underlying our existing laws.³⁵

The weight of consensus within the DAP is that chaos theory is poor evidence for ontological openness in reality.³⁶ In fact, the impact of chaos theory on debates over determinism in nature is two sided. On the one hand, chaos theory enhances any deterministic metaphysical agenda by promising to extend deterministic explanations to complex phenomena that previously were difficult to handle. This serves to remove evidence against metaphysical determinism while adding no further evidence for indeterminism. On the other hand, chaos theory also ensures that the case for metaphysical determinism can never be completely decisive, because chaotic systems can never be tested with the perfect precision needed.³⁷ Construing chaos theory as evidence for metaphysical indeterminism may be futile, but the traditional motivations to affirm indeterminism are by no means any weaker. Human freedom and moral responsibility, as well some interpretations of

quantum measurement, strongly suggest ontological indeterminism, and chaos theory does not block these familiar considerations. Inspiration for defense of ontological indeterminism arises far more naturally from these springs than from the deterministic well of chaos theory. However, because the inspiration is there, the central hypothesis of Polkinghorne's view, that the laws of nature are approximations, remains perfectly feasible. Though the concept of active information in chaotic attractors seems too dependent on determinism and on the reality of chaos in nature to work in its current form, I have argued that these considerations serve merely to constrain the ongoing development of Polkinghorne's view.

Incompatibilist theories of SDA and quantum mechanics: the possibilities

The remaining views on the diagram all develop their positions with reference to quantum mechanics. This only makes sense, because traction as consistency increases as we move rightwards through the diagram, and the existence of stochastic laws governing measurement events allows quantum mechanics to constrain theological claims about divine action more directly than in other spheres of science.

The views of SDA at the quantum level (hereafter, QSDA) differ most on the question of the status of stochastic laws of nature. The three-fold distinction discussed above captures the relevant features of this disagreement: stochastic laws may be descriptive, ontological (in the sense of statistically constraining only ensembles of quantum measurement events), or strong ontological (in the sense of constraining even individual quantum measurement events). The disagreements among DAP participants led to a number of different but viable proposals for objective, incompatibilist, noninterventionist theories of SDA, and I will endeavor to make clear the reasons DAP proposals diverged.

Despite the friendly disagreements, there was complete agreement on one point, namely, that the strong-ontological interpretation of stochastic laws of nature was not the right environment for developing an objective, incompatibilist, non-interventionist theory of QSDA. Tracy thought that the strong-ontological interpretation of stochastic laws of nature in quantum mechanics is probably incoherent. Most others thought the idea probably is coherent but rejected the strong-ontological interpretation as hostile to the goal of a noninterventionist account of SDA. Of course, some people have claimed both that the strong-ontological interpretation of stochastic laws of nature in quantum mechanics is coherent and that theories of QSDA should adopt it, or are somehow committed to it regardless of their protestations to the contrary.³⁸ Yet none of the defenders of QSDA affirms the strong-ontological interpretation of stochastic laws.

The DAP did reach consensus on the various possibilities for QSDA. I will present these options in what follows. As we get started on this, note that a basic grasp of the mathematical formalism of quantum mechanics, and especially quantum measurement, is quite important to avoid errors, so I pause here to give a quick, non-technical summary.

Our current knowledge of the quantum world seems to allow for several places at which God might act, arguably without violating any laws of nature. Most

revolve around the great mystery of quantum mechanics: measurement events. The Schrödinger equation and its relativistic equivalent the Dirac equation describe with great precision the apparently deterministic evolution of quantum systems between measurement events. The model for a quantum system in these equations is a continuous function, a so-called wave function, which assigns a complex number to every space-time point in such a way that, roughly speaking, the square of the wave function is a probability distribution expressing the likelihood that the system will be in a particular state if it were measured.

The mystery of quantum measurement is expressed in Max Born's "projection postulate." Quantum systems when measured are always found in certain basic states, depending on the quantity being measured, whereas the quantum formalism represents the state of an evolving quantum system just prior to measurement as a complicated superposition (linear combination) of these basic states. Every meaningful sort of measurement is associated with a distinctive set of basic states. The projection postulate supposes that, when a measurement occurs, the quantum system irreversibly collapses onto one and only one of the basic quantum states associated with that sort of measurement. If the same type of measurement is performed repeatedly on similarly prepared quantum systems, the resulting statistics show that the probability of obtaining a particular post-measurement state corresponds precisely to the weighting of the post-measurement state in the superposition of basic states that is the pre-measurement wave function.

The quantum formalism is usable and clear on its own terms yet the ontology of the situation is utterly obscure. How does a superposition of basic states suddenly lurch into one and only one of those basic states, conforming all the while to the probabilities specified by quantum theory? What kind of theory predicts measurement outcomes with perfect accuracy using a model of quantum systems that is ontologically indecipherable? As unsatisfactory as this situation is at the level of philosophical interpretation of quantum mechanics, the mathematical formalism itself continues to be experimentally robust and extremely accurate.

DAP participants have pointed out that we must assess the prospects for ontological openness capable of supporting a causal joint for non-interventionist QSDA relative to the various philosophical interpretations of the quantum formalism. There are a couple of dozen such interpretations. Many of these are relevant to the question of QSDA but I do not have space for a comprehensive treatment. Without any discussion, therefore, I make the following simplifying assertions. Recall that DAP proposals for QSDA sought incompatibilist and non-interventionist theories, which require indeterminism in nature. We can exclude non-locality and the Heisenberg Uncertainty Principle³⁹ as suitable places to look for ontological openness, because both are properties of the deterministic Schrödinger equation, which makes the prospects for ontological openness dim.⁴⁰ Likewise, we can exclude all theories that extend the determinism of the Schrödinger equation to the theory of quantum measurement using non-local hidden variables (such as David Bohm's) because of their rejection of indeterminism, and all views that postulate direct divine manipulation of wave functions because of the interventionism involved. We have to exclude interpretations that

face serious theoretical difficulties at the level of the physics, such as continuous spontaneous localization or decoherence theories. Finally, I contend that all of the relevant philosophical issues surface in two of the remaining interpretations, so that we can neglect the others. Specifically, the space for non-interventionist divine action arises in two basic ways: either when the deterministic evolution of a wave function is disrupted at a non-reversible measurement event, as this is described within the standard interpretation of the quantum formalism; or in the strange spaces between quantum worlds that result from measurement events on various quantum-branch scenarios.

We can picture the options for indeterminism in quantum mechanics by means of Fig. 1, which portrays measurement events as if they were several frames in a movie: just before the measurement event, at the onset of the measurement event, the selection of outcome(s) within the measurement event, and the post-measurement state(s).

Region 1, the onset of measurement events, is not well understood in quantum mechanics. Does it require a quantum system to interact with a macro system? With another quantum system? With consciousness? Most importantly, does it have a stochastic element? Only in the case that there is some stochastic element involved in the onset of quantum measurement can we understand region 1 as involving indeterminism. Decoherence theories explicitly propose this but it is not difficult to imagine that a stochastic element could be involved on other interpretations, also. The indeterminism of region 2 appears in the stochastic process governing the selection of outcome events (the projection postulate). Indeterminism in region 3 is more difficult to make out. There are no prospects for indeterminism in region 3 on the standard interpretation but the many-worlds family of interpretations has more flexibility. In Fig. 1, the rounded shape (marked 3a) is supposed to suggest a stage between determination of outcome states (region 2) and the reality of split states (region 3b). We can imagine God acting in region 3a to select among potential worlds before they become actual worlds.

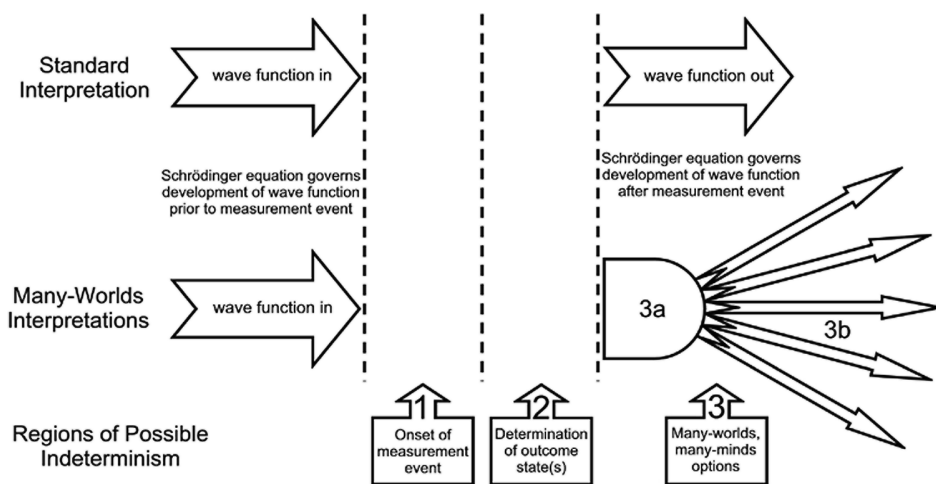


Figure 1 Regions of indeterminism in quantum measurement events

Similarly, after quantum splitting has produced actual worlds (region 3b), it is possible to imagine God acting between these worlds, providing we can construct a view of indeterminism that applies to the strange ontological spaces between and among these split worlds.

The three possible locations of indeterminism in this portrayal of a quantum measurement event lead to six possibilities for objective, incompatibilist theories of QSDA that we might claim are non-interventionist. I list these six options here and defer discussion of the question of their status as noninterventionist because this is their most controversial aspect.

Within the region marked (1), there is one possibility for QSDA in the indeterminism that might exist if there is a stochastic element in the onset of quantum measurement events:

[OPTION #1] God could initiate measurement events.

Within the region marked (2), there are two possibilities for QSDA grounded in the indeterminism of measurement events:

[OPTION #2] God could adjust probabilities to make an outcome state more likely.

[OPTION #3] God could select an outcome state.⁴¹

Within the region marked (3), there are three possibilities for QSDA grounded in the possibilities for indeterminism associated with many-worlds interpretations:

[OPTION #4], within region 3a: God could behold the array of worlds produced by a measurement event “just before” they become real, evaluate them, and then select one world to become actualized while letting the others never come into being.

[OPTION #5], within region 3b: God could attend to some worlds and neglect others.⁴²

[OPTION #6], within region 3b: On the many-minds version of the many-worlds interpretation,⁴³ God could change consciousness so that we are able to construct a different consistent history of reality than otherwise would be possible. This view locates indeterminism in the communication between divine and human consciousness rather than in quantum measurement, but does not explain how this is possible.⁴⁴

The fifth and sixth options yield meaningful perspectives on QSDA. Whether we can give OPTION #5 a non-interventionist rendering would depend on what else we wanted to say about the way God “pays attention.” As far as a causal joint is concerned, this view reduces to other views, which in the quantum context means OPTIONS #1–#3. We could argue that QSDA in the sense of OPTION #6 is non-interventionist on two grounds. On the one hand, we could suppose that no laws of nature (not even the Schrödinger equation) govern this sort of between-the-worlds action on the many-minds interpretation. On the other hand, we could

postulate that the interaction between divine and human consciousness has indeterministic elements. In any event, neither OPTION #5 nor OPTION #6 was formally defended by DAP participants. All of the debates over QSDA swirled around OPTIONS #1–#4, accordingly. Among these four, OPTIONS #1–#3 apply to most interpretations of quantum measurement whereas OPTION #4 only arises in the context of the many-worlds family of interpretations.

The trick in rendering each of the first four options noninterventionistically is to ensure that the ruling interpretation of stochastic laws of nature in quantum mechanics is consistent with noninterventionist divine action within the spheres of indeterminism that each proposes. We have discussed three interpretations of stochastic laws of nature and each has some consequence for theories of SDA, as follows.

First, suppose we interpret laws of nature (including stochastic laws) descriptively, with Murphy and Russell. Then, assuming God's action conforms to these laws (noninterventionism), they describe not only nature's operations but also God's actions within nature, whenever, wherever, however often, and in whatever mode those actions occur. This requires the theologian to view SDA not only as accomplishing God's providential purposes but also as sufficiently regular and mathematically intelligible that scientists can frame the laws of nature. It also strongly invites the theologian to treat the universal aspects of God's action as the ultimate explanation for all of the regularities of nature, an invitation that both Russell and Murphy accept. Once this invitation is accepted, however, given that the laws of nature describe the overall pattern of divine action regardless of level or mode, a meaningful connection between SDA and the quantum world may be in danger. In fact, the only reason to suppose that the quantum level is a distinctive locus for divine action would be that we specify a causal joint for divine action specifically at the quantum level. It is important, therefore, to engage the details of quantum mechanics and make a causal joint proposal if we want both a descriptive account of laws of nature and a concretely intelligible theory of QSDA.⁴⁵

Second, if we interpret stochastic laws of nature ontologically, in the sense of constraining only ensembles of events (with Ellis and Tracy), then these laws do constrain God's action in a minor way, if it is to be noninterventionist. God must be sure to make experiments in which scientists gather quantum statistics come out right. This is definitely an awkward constraint in the sense that human beings can more or less force God to act in a particular way, constraining the divine freedom. Yet in practice it is not so severe, particularly if God only acts in some but not all events, because providentially relevant events are unlikely to include anything about which scientists can gather quantum statistics.⁴⁶

Finally, if we interpret stochastic laws of nature in the strong-ontological sense, which constrains each individual quantum measurement event, then any action of God will violate those laws and noninterventionist versions of QSDA will be impossible. No DAP participant defending a noninterventionist theory of QSDA holds this view of the laws of nature, obviously, but some DAP participants arguing against QSDA (such as Peacocke) appear to believe that this view of stochastic laws of quantum mechanics is the correct one.

Incompatibilist theories of SDA and quantum mechanics: two critiques

Since Saunders has gone to great lengths to comment on existing proposals for QSDA,⁴⁷ it is worthwhile pausing to assess his arguments. We can also generate a hypothetical but illuminating critique of efforts to develop theories of QSDA based on Kant's analysis of the powers of human reason. I will discuss both of these critiques in what follows.

First, we turn to Saunders. *Divine Action and Modern Science* makes a significant contribution to debates over SDA especially because Saunders gives detailed attention to so many of the relevant philosophical, theological, and scientific issues. In particular, he gives a clear and reasonably accessible presentation of most of the features of quantum mechanics relevant to deciding whether a proposal for QSDA is consistent with what scientists believe is the case in quantum mechanics.⁴⁸ His presentation is not quite comprehensive in its coverage of indeterministic interpretations of the quantum formalism,⁴⁹ which matters because his argument that contemporary theology is in crisis depends on not overlooking any promising alternatives. Nevertheless, his presentation of quantum mechanics should prove useful to theologians who want an accessible introduction to quantum mechanics and its interpretation.

In relation specifically to QSDA, we might ask how Saunders constructs his argument. Though he does discuss the proposals of Ellis, Murphy, Russell, and Tracy,⁵⁰ his primary argument unfolds independently of the consideration of particular positions.⁵¹ This is helpful because it minimizes debates over fine points of interpretation and keeps the focus on the conceptual structure of proposals for QSDA. Saunders follows the incompatibilist strategy of seeking indeterminism in the quantum realm (which requires selecting an interpretation of the quantum formalism) and then trying to develop a noninterventionist form of QSDA within that indeterministic space. For our limited purposes, it is sufficient to consider his discussion of indeterminism and QSDA relative to the standard interpretation of the quantum formalism, because all of his disagreements with QSDA proposals within the DAP emerge in this context.

Rightly rejecting divine manipulation of wave functions between measurements as bluntly interventionist, Saunders identifies three ways in which the standard interpretation of quantum mechanics may be indeterministic and thus three ways to conceive of QSDA. These correspond to OPTIONS #1–#3 discussed above (OPTIONS #4–#6 do not arise for the standard interpretation of the quantum formalism). So far, then, there is agreement with the DAP on the options for QSDA. What does he say about each one?

Regarding OPTION #1, which proposes that God may make measurements on a quantum system, Saunders points out three difficulties. First, the empirical adequacy of quantum mechanics depends on there being no unexpected collapses intervening between measurements, as there might be if God initiated measurement events. Second, because measurements involve the interaction of parts of nature, God cannot contrive to cause an interaction without intervening. Third, God cannot control the outcomes of a measurement event using this approach, but only trigger a measurement event and leave the outcome to chance, which is theologically awkward.

The first of these objections is unimportant in practice, as there is no reason to think that God would be providentially initiating measurement events in physics experiments. Anyway, the vagaries of any experimental apparatus entail that assessing anomalous data is a statistical process, which leaves plenty of room for masking divine initiation of measurement events in the statistical noise of experimentation. The third objection is spurious because nothing prevents combining OPTIONS #1 and #3, thereby allowing God both to trigger measurement events and to select their outcomes. The second objection is more serious because, on that view of the onset of measurement events, there is no indeterminism whatsoever. However, recall that the DAP conclusion about OPTION #1 was that noninterventionist divine initiation of quantum measurement events is possible only if there is some stochastic element in the onset of measurement and if the relevant laws of nature are not given a strong-ontological interpretation. There is no reason at this stage in the development of quantum theory to rule out stochastic elements within the onset of quantum measurement events. Unfortunately, Saunders does not address this possibility, but it matters little because no DAP participant consistently affirmed OPTION #1.⁵²

Regarding OPTION #2, that God may alter the probability of obtaining a particular result in a quantum measurement event, Saunders' main objection coincides with that entered here, namely, and in my terminology, that this option presumes a strong-ontological interpretation of stochastic laws of quantum mechanics and thus is interventionist. Of course, the fact that Saunders does not use the same terminology as the DAP at this point complicates judgment slightly, but the arguments seem to match.

Regarding OPTION #3, that God may select the result of a measurement event, Saunders is similarly pessimistic. Unlike the unimportant disagreement over OPTION #1 and the agreement over OPTION #2, however, the disagreement with DAP conclusions in the case of OPTION #3 is serious indeed and we very much need to understand it. Saunders' lack of clarity about statistical constraint of ensembles of events versus constraint of individual events in the interpretation of stochastic laws of quantum mechanics lies at the root of the disagreement. The categories he uses in his analysis of laws of nature concern whether probabilities are ontologically prior to or derivative from measurement events. These terms are too coarse in respect of expressing only two options rather than the three relevant options (descriptive, ontological, strong-ontological). They are also too vague in respect of being untranslatable into the language of statistical constraints on ensembles or theoretical constraints on individual events. Nevertheless, in an attempt to understand what can be understood, consider Saunders' key argument about OPTION #3 [my comments are in square brackets]:

The technical substance of this approach is to deny that Born's probability interpretation of the wave function [i.e. the projection postulate] has any ontological priority and assert that it is simply an approximate relationship between ensembles of identical systems for a given measurement repeated a large number of times. The next move is to interpret quantum laws in a regularitarian methodology [i.e. as descriptive]—a move that is quite at odds with the position of every proponent of quantum SDA considered above [including Ellis, Murphy, Russell, and Tracy].⁵³

There appear to be several problems here. First, an ontological interpretation of the projection postulate does not deny all ontological priority to the probabilities; it regards them as “ontologically prior” but as constraining ensembles rather than individual events. Saunders here suggests without argument that we have to embrace a strong-ontological interpretation of quantum laws of nature. However, if we really do have to embrace a strong-ontological interpretation of the laws of nature, then we do not need these two chapters of his book or a bunch of conferences to conclude out that a non-interventionist account of QSDA is impossible. That is why DAP participants advancing theories of QSDA reject the strong-ontological interpretation of stochastic laws of nature. Second, Saunders mistakenly assimilates the ontological and descriptive interpretations of stochastic laws of nature, thereafter arguing against both by attacking only the descriptive interpretation. Third, in the final sentence, Saunders simply mischaracterizes the positions of proponents of QSDA. As a result of these considerations, Saunders’ discussion of OPTION #3 never achieves optimal clarity, his invidious “either/or” choices overlook more feasible alternatives, and he produces no arguments capable of unsettling the conclusion of the DAP that OPTION #3 is feasible so long as we reject a strong-ontological interpretation of the relevant stochastic laws of nature.

This is a key lapse in a book that usually is argued closely and well. It serves as evidence for Saunders’ own point, namely, that approaching analysis of options for SDA with inadequate distinctions (in this case, pertaining to stochastic laws of nature) can produce misleading results. How did this happen? I would conjecture that Saunders has an intuition that the strong-ontological interpretation of stochastic laws must be correct. Yet instead of simply arguing for this and then drawing the obvious conclusion that noninterventionist QSDA is impossible, he presents an unnecessarily complicated argument with the same conclusion, without materially new conceptual elements. Saunders does not adequately explain his attachment to the strong-ontological interpretation of stochastic laws of nature, though we should expect to find such an explanation given the way his argument against QSDA proposals depends on it.⁵⁴

Moving from Saunders back in time to Kant, we find the inspiration for an elegant tetralemma argument that can serve as a lens for viewing the strategic moves made within the DAP as participants sought to develop theories of SDA. This argument is particularly illuminating in the case of theories of QSDA.

To frame the tetralemma argument, let us assume (contrary to fact, for most DAP participants) the most demanding criterion for an adequate theory of SDA, namely, the following conjunction of four propositions: objectivity, incompatibilism, noninterventionism, and strong-ontological view of laws of nature. Then the argument concludes that all theories of SDA fail to meet this criterion. If this argument against the possibility of SDA is valid—and no view of SDA that I am aware of challenges the entailment—then we can protect SDA only by weakening or rejecting one of the four propositions defining the criterion for success. Of course, no DAP participant accepts this four-fold criterion as the desirable goal for a theory of SDA. The various moves within the DAP can still be analyzed along these lines, and there is a payoff in insight for making the effort.

With the tetralemma argument now in place, let us consider the secret of its validity (note: not its soundness!). It is an application to the specific context of QSDA of a more general point that Kant made long ago. Kant argued that we never could give a causal analysis of reality in such a way to justify our intuitions of human freedom and moral responsibility.⁵⁵ Whenever we try to use our ordinary reasoning powers (from causes and other such categories) to articulate and justify human freedom, we find ourselves illustrating his antinomy of pure reason: we simply cannot get there from here. For Kant, we can only reconcile categories of causality and human freedom in compatibilist fashion by postulating human freedom as a condition for the possibility of our experience; we can never demonstrate its consistency with a causal, scientific account of nature.

Kant's transcendental philosophy has not survived the transition away from deterministic Newtonian physics as well as Kant might have wanted, but the deep point he makes about the antimony of pure reason remains difficult to dismiss. In our era, we still encounter the phenomenon Kant described: the more precise our articulation of causal joints, the more elusive ontological openness becomes, and the more we confirm our suspicions that we need to switch away from an incompatibilist approach in order to make the postulate of human freedom credible. In one respect, Kant's insight is independent of the apparatus of the transcendental dialectic of the *Critique of Pure Reason*. Science is causal language from beginning to end and only fitted to describe the causal web of reality. Where the scientific project of detailing the causal web runs aground, as it does in the quantum measurement problem, science lapses into silence; there can be no scientific account of the workings of indeterminism. Within this silence, however, the speculative metaphysical urge to continue the scientific project of explaining how things work lifts its voice and keeps us busy, despite its intrinsic limitations. In our time, it is arguments over the philosophical interpretation of laws of nature that express this urge. When we accept the strong-ontological interpretation of laws of quantum mechanics, we drive the controlling powers of scientific laws of nature all the way into each individual quantum measurement event, thereby subjecting even ontologically indeterministic processes to rigid (probabilistic) laws that destroy the incompatibilist project of locating human freedom to act in ontological indeterminism. That is why Kant was a compatibilist. Moreover, while Kant's immediate concern was human freedom to act, his argument applies equally well to divine freedom to act.

With Kant in mind, we can portray the DAP in general terms as trying to satisfy the theological urge to locate human and divine freedom in the causal web of nature while struggling with Kant's insight about the antinomy of pure reason. The struggle is least compelling when we reject objective SDA or when Kant's own or another compatibilist approach relaxes the tension between categories of freedom and categories of causation. It is more compelling when we adopt an incompatibilist approach, and more difficult still when we force our inquiry to abide by conditions that maximize traction between metaphysics and science, such as ontological interpretations of the laws of nature and non-interventionism. As our causal account of the joint of divine action becomes most precise, as it does if we embrace the four-fold criterion of the tetralemma argument, we will discover

exactly what Kant implied that we would, namely, that the vision of divine freedom to act vanishes the way a mirage in the desert vanishes when we approach it. To avoid this, we will have to pull out of the intellectually suicidal dive that speculative metaphysics takes us on: we will have to relax the constraints that maximize traction between metaphysics and science or else collide with the immovable fact that we can never argue from categories of causality to categories of freedom. Our choice is when to pull out of the dive. Which of the traction-maximizing constraints on our inquiry will we relax?

Within the DAP, the problem does not arise for Davies, Drees, and others who deny the objectivity of SDA. Clayton, Peacocke, Soskice, Stoeger, and Ward realize the prognosis early on and submit more completely than others do to Kant's strictures on speculative metaphysics.⁵⁶ The others stay on course for Kant's predicted collision longer by embracing objectivity, incompatibilism, and noninterventionism. Within this metaphysically more aggressive sphere of theological work, traction (as consistency) between theology and science is strongest, yet there are still ways to position theories of SDA that avoid Kant's antinomy. That is, we can still ask precisely where and how in our speculative metaphysical interpretation of quantum measurement events God is supposed to act. In this way, we will entertain a more detailed causal story (though of course elaborated not scientifically but metaphysically) and more heavily constrain our theological assertions about divine freedom. Polkinghorne weakens the incompatibilist commitment by stressing the provisional status of existing laws of nature. Murphy and Russell treat the laws of nature as describing God's universal (or in Russell's case almost universal) action in nature. Ellis and Tracy accept an ontological interpretation of laws of nature, which statistically constrains ensembles of quantum events but not individual measurement events, and thereby enjoy the greatest degree of traction, but they too avoid the Kantian specter of the collapse of speculative metaphysics. If we maximize traction still further by accepting (with Saunders?) a strong-ontological interpretation of the stochastic laws of quantum mechanics, then the inability of causal categories to comprehend categories of freedom will force us to conclude that prospects for theories of QSDA are grim, and Kant's prophecy of doom will be fulfilled.

If the argument here is correct, then the relaxation of constraints—constraints that theories of SDA use to generate traction (as consistency) between science and theology—is unavoidable, for Kant's reasons. Nevertheless, it is also unproblematic so long we regard the demanding four-fold criterion as dispensable. In terms of this Kantian perspective, I think Saunders' critique amounts to holding an inevitable outcome of a speculative metaphysical venture against the theorists, as if they could with more care or more imagination or more attention to detail somehow avoid it. With that in mind, we might consider steering away from representing the relaxation of ideal constraints on theories of SDA as failures to reach a goal, which after all is illusory anyway. Rather, having established the technical feasibility of SDA proposals, we should celebrate the artistry of these intellectuals. We should then understand this artistry in terms of the way traction is first maximized for the sake of concrete intelligibility of theological proposals, and then relaxed in a variety of ways for the sake of avoiding the collapse of

theories of SDA under the implacable weight of the tetralemma argument and the limitations of human reason that it describes.

Incompatibilist theories of SDA and quantum mechanics: specific proposals

Having articulated the options for QSDA and defended the feasibility of most options in general terms, I now briefly analyze similarities and differences among the four specific proposals made within the DAP: those of Ellis, Murphy, Russell, and Tracy.⁵⁷

These four views have in common the view of the causal joint of divine action: it is OPTION #3, above. This option hypothesizes that God selects the outcomes of measurement events. Russell has experimented in his published writings with OPTION #1, that God initiates measurement events,⁵⁸ and Murphy has experimented with OPTION #4.⁵⁹ No DAP participant formally defended OPTION #5 or OPTION #6, though I explored the latter in the final conference meeting,⁶⁰ and OPTION #2 is not promising, as noted above. Of all DAP participants, Tracy has most clearly resisted the idea that one has to choose one approach rather than others; in fact, he has clearly stated that he does not hold that God acts only at the quantum level, or even exclusively in causal gaps in nature.⁶¹

The differences among the four DAP participants advancing specific quantum-level proposals for SDA pertains to the scope of divine action, in three senses. First, there is the question about whether God acts especially at the quantum level always and everywhere or only at particular places and times. This difference is most evident in the comparison of Murphy's affirmation of divine action at every time and place⁶² with Tracy's view of intermittent quantum special divine action.⁶³ Ellis sides with Tracy on this issue. Interpreting Russell's view on this point is more complex but his developed view is quite clear: God acts in all quantum measurement events and only refrains from acting when a free, conscious agent acts instead.⁶⁴

Second, in relation to those theories postulating that God acts in all quantum events (Murphy and Russell), there is the question of whether God's special action is necessary to those events, and in what sense.⁶⁵ Everyone in this debate wants to avoid the theologically and morally objectionable view of occasionalism, whereby God is the only actor in reality and the laws of nature merely describe divine action rather than structures of reality created by God to have some measure of independence. Occasionalism represents the strongest sense in which God's special action might be necessary for ordinary events (in any sense of "event"): God is the ontological condition for the possibility that ordinary events occur at all and determines every event. Near the opposing end of a spectrum of views of the necessity of God's action (see the diagram, below) lies Russell's view, namely, that God does not need to act in any event, beyond merely sustaining creation in existence, but acts intentionally in every event anyway in order to accomplish providential purposes. Of course, rather many quantum measurement events in cosmic history may seem providentially irrelevant, but part of divine providence on Russell's view is God's faithful maintenance of patterns of regularity in nature.

Between these two extremes are a number of views that reject occasionalism yet affirm that God's special action is ontologically necessary in some sense. For example, toward the Russell end of the spectrum, one interpretation of the process metaphysics account of causation has God playing an ontologically essential but not a constitutive role in every event, in the sense that God must exercise influence in some events or the world as we see it would not be possible (the ontologically essential part). Yet, if God did not furnish an initial aim to a particular actual occasion, concrescence of that occasion would still occur (the non-constitutive part). On another view of process causality, God's action is more than ontologically essential; it is constitutive though still not determinative for every event because it conveys structured possibilities to each actual occasion, without which concrescence would not occur. Toward the occasionalism end of the spectrum lies the view of divine determinism, which posits some degree of independence of the created world from God (as in process metaphysics) and assigns God the role of selecting every outcome of every event (as in occasionalism). The precise sense in which God is necessary to every event differs among the several variants of this view. Karl Heim thought that God determined every aspect of the world through action at the quantum level.⁶⁶ William Pollard seems to argue much the same, despite his more comprehensive way of expressing himself.⁶⁷ In these cases of omnideterminism, the necessity of God's action seems to amount to the strong claim that God must play this role if nature is to function properly. Within the DAP, Murphy seems closest to Heim and Pollard (as the phrase "hidden variable" and other references suggest).⁶⁸ Murphy also refers to the principle of sufficient reason in justifying her construal of God's universal action at the quantum level, which is another type of necessity. Yet Murphy is clear that God voluntarily respects the "natural rights" of all created entities, which probably evades divine determinism and certainly affirms the beauty and order of God's creation.⁶⁹

Third, there is the question about the situations in which God acts at the quantum level, and whether God constrains divine action in order to support the flourishing of free, conscious creatures such as us. Russell imagines a shift in divine strategy. Prior to the emergence and outside the realm of free, self-conscious creatures, Russell proposes that God works in all events to bring about the divine will for the natural world, from cosmos to ecosphere. Russell further hypothesizes a grace-filled, kenotic contraction of this divine activity in order to create the possibilities needed to make freedom meaningful for self-conscious moral creatures such as human beings. Divine providence withdraws to allow such creatures the freedom they need to explore their moral potential, and God no longer acts in all quantum events but only in some.⁷⁰ Both phases of divine activity involve the same mechanism of divine action and differ only in scope.⁷¹ Moreover, every quantum event has either God or a created conscious agent acting in it, yet this action is not constitutive of these events, in the sense that events would still occur even if God did not act. Russell's motivation for asserting the universality of divine action while not following Murphy in making divine action constitutive of quantum measurement events is theological in character: he wants to secure the omnipresence and omni-activity of God. George Ellis proposes that the principal

Table 3 Characteristics of Views of Special Divine Action at the Quantum Level

God can act freely		God can only persuade		God can act freely			
God acts specially in all events				God acts specially in some events but not in others			
God's action is universal in scope			Everywhere except realm of sentience	Anywhere providentially relevant	Especially human minds		
God's special action is constitutive of events (events cannot occur unless God acts specially)			God's special action is not constitutive of events (events occur whether or not God acts)				
God determines every event (divine omnideterminism)		God respects the created rights and ontological independence of creatures and does not determine every event					
God is the only actor	God sustains the activity of other creatures and processes						
Occasionalism	Heim, Pollard	Murphy	Process (strong)	Process (weak)	Russell	Tracy	Ellis

(perhaps exclusive) mode of God's action is at the quantum level. He construes God's purpose to be the communication of divine inspiration and guidance to human beings, along the lines of the Quaker belief in the experience of the light of God within, all the while respecting the freedom of human beings to make their own choices.⁷²

Table 3 presents the dimensions of variation among views of QSDA. The diagram uses rows to express the relevant characteristics of proposals for QSDA and columns to line up combinations of characteristics with the eight particular views mentioned above.

Though the territory is complex, the DAP's conclusion is clear: there are several viable possibilities for theories of SDA at the quantum level.

Conclusion

I have here presented my reading of the DAP's conclusions and analyzed the disagreements among participants, with special reference to the papers and discussions of the recent capstone meeting. I have also addressed a couple of criticisms of proposals made within the project. We can now return to the question with which we began, namely, whether contemporary theology is in crisis because of a failure to present a credible theory of SDA, as Saunders alleges, or whether in fact theology has made significant progress in this area.

I have tried to explain the root of the disagreement between many DAP participants and Saunders, tracing it back to the insensitivity of his analytical categories to the three-way distinction among interpretations of stochastic laws of nature used within the DAP. If Saunders were to allow that correction to his otherwise impressive argument, it seems that his conclusion about SDA at the quantum level could not help but be more positive. Moreover, Saunders seems optimistic about Polkinghorne's general strategy of treating the laws of nature as approximations to an underlying indeterminate reality within which God can act freely, even though he shares my concerns about Polkinghorne's way of using chaos theory to articulate a causal joint. Saunders also seems sympathetic toward compatibilist proposals, especially Peacocke's. On the terms of his own argument, therefore, and quite apart from the key dispute over interpretation of laws of nature, I cannot quite see why Saunders is so pessimistic. From my point of view, theological theories of SDA are as strong as they have been at any time since Hume and Kant, and this is largely because of the contributions of the DAP.

In closing, it is important to note that many issues discussed in the DAP do not register at all in my survey to this point. Perhaps most prominent among the issues so far unmentioned is the problem of good and evil, and particularly the related problem of theodicy. There was wide agreement among DAP participants that any postulate of SDA exacerbates the theodicy problem,⁷³ so a lot of energy was expended in trying to deal with this. In particular, the tendency to affirm universal divine action, whether in process metaphysics (Barbour, Birch, Haught) or in personalist theism (Murphy, Russell⁷⁴) seemed motivated in part by the desire to minimize, without eliminating, the severity of the theodicy problem. Likewise,

some (including Ellis⁷⁵) invoked the concept of kenosis outside its original sphere of application in Christology to explain why God does not act more often to ease pain and to educate us wayward creatures who so obviously need more guidance than we get. In this way, kenosis was used to strengthen the best-world, free-will, and free-process defenses of God's goodness that various participants articulated (especially Tracy⁷⁶). Some participants thought that no amount of rational reflection would yield a satisfying answer to the question of God's goodness on best-world or free-will grounds. They argued for a return to one traditional Christian approach (not strictly a solution) to the problem, which has God somehow sharing in the suffering of the world through the incarnation and crucifixion of Jesus (Edwards, Moltmann, Russell⁷⁷). Still others (Drees, Wildman) regard the problem of theodicy as crippling to all proposals of SDA and so propose interpretations of ultimate reality that reject the idea that God can form intentions and act specially at all. It was obvious to all within the DAP that the problem of good and evil, and the related problem of theodicy, require more attention than we were able to give them in the context of our study of SDA, but that is no surprise. The road of theological inquiry goes ever onwards.⁷⁸

Appendix A: decision tree diagram of options in theories of special divine action

The virtue of a decision tree is to draw attention to key choices that theorists of SDA make, explicitly or implicitly, on their way to settled views. The disadvantage is that all interesting views are always subtler than a diagram can represent, balancing many complex considerations. It follows that a figure is no substitute for a detailed understanding of the textured views themselves. I defined the terminology in the decision tree figure (Fig. A1) within the body of this essay. Some features of the figure are difficult to grasp without commentary, however, so this Appendix includes a brief explanation of the figure.

The decision tree links related positions using a simple line and bracket system. For example, the decision to represent Ultimate Reality theistically or non-theistically corresponds to the left-most bracket on the figure. The next decision arises within the theistic context, and pertains to God's nature: God either can or cannot (literally) act intentionally. The figure records the fact that I hold the latter view (labeled "God as Ground of Being or Being Itself" on the diagram) while most DAP participants hold the former. In general, the names of views are printed in small italic type, the holders of views in small bold type, and the propositions characterizing the content of views in larger normal type. The figure's presentation of any particular position as the outcome of a sequence of decisions means that we can describe each view as a conjunction of the propositions characterizing the decisions made. For example, Ellis's view affirms (Ultimate Reality as God) and (God can [literally] act intentionally) and (God does act intentionally) and (God Can Choose to Act Intentionally Only in Some Events [yet May Act in All Events]) and (God Causally Initiates Specific Events) and (God Acts in Conformity with Natural Laws) and (God's Mode of Action is Rationally Approachable) and

(Causal Joint of Divine Action Can Be Discussed to Some Degree) and (God's Action Requires Ontological Openness for Causal Joint). The figure does not describe the particular causal joint that Ellis defends; see the body of the essay for that.

We can imagine a more complex figure with further decisions drawn in under most views. Several other figures within this paper elaborate the more complicated parts of the tree so as to draw out subtler distinctions among DAP views lumped together in this figure. The view that (God Causally Initiates Specific Events) receives the most attention because that is where most debate within the DAP took place. The diagram shows how decisions specifying this view are either interventionist or noninterventionist, and how the latter views are compatibilist or incompatibilist. It is important to note, however, that other parts of the diagram could be elaborated in the same way. For example, the view that (God Necessarily Acts Intentionally in Every Event) includes both compatibilist and incompatibilist options, but these are not distinguished in the figure itself.

The figure has a number of more serious limitations. For example, Tracy's attempt to defend the intelligibility of several modes of divine action means that his name appears several times on the figure. Murphy's view is awkwardly distant from other quantum-level proposals on the diagram because it asserts "God Necessarily Acts Intentionally in Every Event." The distinction between more personalist (Thomistic) and more mechanistic (Aristotelian) variations on the primary-secondary causation model is important, but these views are listed separately from the "God as Ground of Being or Being Itself" view, which is unfortunate. Moreover, the distinction between Non-Theistic and Ground-of-Being views is difficult to stabilize. Finally, the concept of Ultimate Reality is extremely contentious within religious studies.

Endnotes

- 1 Nicholas Saunders, *Divine Action and Modern Science* (New York and Cambridge: Cambridge University, 2002). Saunders concludes, "Would it be correct to argue on the basis of the foregoing critique that the prospects for supporting anything like the 'traditional understanding' of God's activity in the world are extremely bleak? Largely the answer to this question must be yes. *In fact it is no real exaggeration to state that contemporary theology is in crisis*" (215; italics in original).
- 2 The volumes in the DAP series, together with corresponding conferences and the abbreviations of volumes used throughout this paper, are as follows. All are published jointly by Vatican Observatory Publications and the Center for Theology and the Natural Sciences and distributed by Notre Dame University Press, and all have the subtitle *Scientific Perspectives on Divine Action*.

Publication

Quantum Cosmology and the Laws of Nature [QCLN], eds Robert J. Russell, Nancey Murphy, C. J. Isham (1993)
Chaos and Complexity [CC], eds Robert John Russell, Nancey Murphy, Arthur Peacocke (1995)
Evolutionary and Molecular Biology [EMB], eds Robert John Russell, William R. Stoeger, Francisco J. Ayala (1998)

Conference

1992, Rome
 1994, Berkeley
 1996, Rome

Publication

Neuroscience and the Person [NP], eds Robert John Russell, Nancy Murphy, Theo C. Meyering, Michael A. Arbib (1999)
Quantum Mechanics [QM], eds Robert John Russell, Philip Clayton, Kirk Wegter-McNelly, John Polkinghorne (2001)

Conference

1998, Poland
 2000, Rome

Prior to the first conference there was a preliminary and preparatory conference that produced the volume *Physics, Philosophy, and Theology: A Common Quest for Understanding* [PPT], eds George V. Coyne, Robert J. Russell, William R. Stoeger (Notre Dame University, 1988). A related book concerns the views of Pope John Paul II, together with expert commentary: *John Paul II on Science and Religion: Reflections on the New View from Rome*, eds Robert J. Russell, William R. Stoeger, and George V. Coyne (Notre Dame University, 1990). The *Evolutionary and Molecular Biology* volume includes an address given by Pope John Paul II to the Vatican Observatory Conference at the 1996 meeting. A book may or may not flow from the final capstone conference. Summaries of all 5 introductions and 91 articles, the work of 50 authors, are available on the CTNS website, <http://www.ctns.org/books.html>.

- 3 See Maurice Wiles, *God's Action in the World* (London: SCM, 1986).
- 4 It may also be worth noting that, though I do not know Saunders personally, I have a great deal of respect for the Cambridge advisor of the dissertation from which the book flows, Sir John Polkinghorne, and for Saunders' sometime discussion partner, Arthur Peacocke, both of whom have been key participants in the DAP. Needless to say, I hope these warm thoughts and feelings do not interfere with my judgment.
- 5 The other effective project was the Boston-based Crosscultural Comparative Religious Ideas Project, led by Robert Neville, Peter Berger, and John Berthrong. The output of this series of 25 day-long conferences was three volumes, all edited by Neville and published by SUNY Press in 2001: *The Human Condition*, *Ultimate Realities*, and *Religious Truth*.
- 6 It is not easy to classify people, particularly in the case of participants such as Ernan McMullin and Fraser Watts. The list of specialist participants in the DAP not already mentioned and without categorization (and probably not error free), is as follows: Michael Arbib; Francisco Ayala; Michael Berry; Leslie Brothers; Jeremy Butterfield; Camilo Cela-Conde; Julian Chela-Flores; Michael Chiao; Chris Clarke; Anne Clifford; James Cushing; Paul Davies; Langon Gilkey; Joel Green; Andrej Grib; Peter Hagoort; Chris Isham; Marc Jeannerod; Fergus Kerr; Bernd-Olaf Küppers; Joseph LeDoux; John Lucas; Gisele Marty; Theo Meyering; Michael Redhead; and Abner Shimony. One question the DAP did not answer is why this list of specialist participants is so improbably loaded toward the first half of the alphabet. Note that the capstone conference included participants on the theological side not previously involved in conferences: Paul Allen; Niels Gregersen; Owen Thomas; Kirk Wegter-McNelly (involved in editing several DAP volumes); and Mark Worthing.
- 7 St Thomas's analogy of being famously must confront difficulties about human ignorance of the divine mode of being. Karl Barth's analogy of faith begs questions of biblical authority and sources for theological knowledge. Communitarian theologies that try to stabilize theological terms with reference to practices and beliefs of a community pretend at epistemological self-containment and independence from other forms of knowledge, whereas this is demonstrably not the case.
- 8 See Happel, "Metaphors and Time Asymmetry: Cosmologies in Physics and Christian Meanings," in *Quantum Cosmology and the Laws of Nature*; Happel, "Divine Providence and Instrumentality: Metaphors for Time in Self-Organizing Systems and Divine Action," in *Chaos and Complexity*; Heller, "Generalizations from Quantum Mechanics to God," in *Chaos and Complexity*, especially 191–193; and Watts, "Cognitive Neuroscience and Religious Consciousness," in *Neuroscience and the Person*, especially 340–341. Soskice was particularly conscious of issues about the status of theological language.
- 9 This survey does not cover the DAP's discussions of GDA, mostly because the focus was

on SDA. The *Quantum Cosmology and the Laws of Nature* volume contains the essays that paid most attention to GDA, and the key paper on this topic is probably Russell, "Finite Creation without a Beginning: The Doctrine of Creation in Relation to Big Bang and Quantum Cosmologies."

- 10 See Russell, "Bodily Resurrection, Eschatology, and Scientific Cosmology," *Resurrection: Theological and Scientific Assessments*, eds, Ted Peters, Robert John Russell, Michael Welker (Grand Rapids, MI.: Eerdmans, 2002), 3–30; the diagram and associated discussion are on 10–17. Alternatively, see Russell, "Eschatology and Physical Cosmology: a Preliminary Reflection," *The Far Future Universe: Eschatology from a Cosmic Perspective*, ed. George F. R. Ellis (Philadelphia: Templeton Foundation, 2002), 266–315; the diagram and discussion are on 275–279, 284–288.
- 11 In "Special Providence and Genetic Mutation," Russell states that he does not wish to disparage interventionism but only resist its unnecessary use, acknowledging that interventionist readings of such events as incarnation and resurrection "might be justifiable and necessary after suitable nuancing, since when the domain of God's action is eschatological the 'laws of nature' (i.e. God's faithful action) themselves will be different and 'intervention' may cease to be a useful concept" (*Evolutionary and Molecular Biology* 200, fn. 21). We might construe this idea as interventionist, non-interventionist, or even more-than-interventionist, depending on our point of view. Thus, Russell's view of eschatologically momentous events shows that the categories of interventionism and noninterventionism are somewhat inflexible. Yet the distinction remains useful for many purposes.
- 12 Ward cites the view of Rom Harré that we should interpret the regularities of nature, not as laws but as inherent capacities or dispositions or tendencies of objects. This view underlies Ward's conception of the potential for transformation within human beings.
- 13 See the diagrams in the Introductions to *Chaos and Complexity* and *Quantum Mechanics*.
- 14 Among DAP participants, Tracy was particularly concerned to defend the possibility that one might be a compatibilist in respect of one sort of divine action and an incompatibilist with respect to another. If Tracy is correct, then of course theo-physical (in)determinism would be importantly different than anthropo-physical (in)determinism. Specifically, unlike divine action as Tracy imagines it, we must conceive of human action either in compatibilist or in incompatibilist terms, but not both, because human beings are always subject to the regularities of nature. This is one example of the care the DAP took to notice failures of the analogy between divine and human action, as well as similarities between the two.
- 15 The ontological options expressed here are translations into this context of the major options in the medieval debates over universals: the realists spoke of universals as having independent reality (this corresponds to the ontological approach, which has empiricist and rationalist versions), whereas their nominalist opponents denied any reality to universals (this corresponds to the descriptive approach). Meanwhile, the Scotists affirmed the independent reality of universals but insisted that they were only ever present in "contracted" fashion as the form of the actual concrete being of particulars (this view is also included here under the ontological approach).
- 16 Another reason (Stoeger's and the Thomists') for this intuition is that quantum-level SDA makes God an ordinary (secondary) cause like other causes. Of course, this concern potentially applies to SDA in any mode.
- 17 See Robert Cummings Neville, *God the Creator* (Chicago: University of Chicago, 1968). Note that John Scottus Eriugena also speaks about God determining the divine nature in the act of creation.
- 18 Peacocke's view is laid down in *Theology for a Scientific Age*, enlarged edition (London: SCM, 1993). Clayton intimates his view in a few existing publications but the main work has not yet appeared.
- 19 See Whitehead, *Process and Reality*, corrected edition (New York: Macmillan, 1978).
- 20 Of course, the phrase "top-down" is used in many ways, which makes a precise

discussion difficult to achieve. For example, my working hypothesis is that ordinary causes marshaled by complex systems are sufficient to explain all of the behavior we see around us, including mental causation. I also hold that the dignity and value of minds and ideas is secured by their ontological status as emergent realities, even though this weak sort of emergence does not entail any strong form of mental causation as new causal powers ontologically irreducible to ordinary causation operating within the complex world of brains-in-contexts. (I care more about securing the value of minds and ideas than I do about their ontological status.) Clayton disagrees, taking his stand on the view that certain emergent levels of reality do confer new and irreducible causal powers, pointing especially to life and mind, but taking the final decision on precisely where these new levels of causal power emerge to be largely an empirical question. While these are very different views in respect of their presuppositions about the ontology of causation, both are characterized as affirming “top-down” causation at one point or another in the confusing literature on the subject. From this, it follows that, in this area as in so many others, names for positions are invidious and that only patient conversation can discriminate genuinely different views in satisfying ways.

- 21 See Polkinghorne, “The Metaphysics of Divine Action,” in *Chaos and Complexity*. He writes, “The deterministic equations from which classical chaos theory developed are then to be interpreted as downward emergent approximations to a more subtle and supple physical reality. They are valid only in the limiting and special cases where bits and pieces are effectively insulated from the effects of their environment. In the general case, the effect of total context on the behavior of parts cannot be neglected” (153).
- 22 See Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 154.
- 23 Saunders has suggested that Polkinghorne’s position has been widely misinterpreted but most of his citations are to positions that I think interpret the [Polkinghorne] view correctly and merely dispute the arguments Polkinghorne uses to support it; see *Divine Action and Modern Science*, 186–196, especially 186 and 196. In fact, Saunders makes the same critique of Polkinghorne’s epistemology-models-ontology argument that Drees, Murphy, Tracy, Russell, and others have made. I do not see evidence in Saunders’ presentation to support his claim of widespread misinterpretation.
- 24 Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 147–149, 153.
- 25 See the description in Wildman and Russell, “Chaos: a Mathematical Introduction with Philosophical Reflections,” *Chaos and Complexity*, 71–74.
- 26 Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 147–148.
- 27 Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 148.
- 28 Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 148–149.
- 29 Polkinghorne, “The Metaphysics of Divine Action,” *Chaos and Complexity* 153.
- 30 Polkinghorne sometimes speaks as if the determinism insisted on by his critics is the physical determinism expressed in Newton’s mechanics, when he writes “the claim that chaos theory is intrinsically deterministic” both that “[t]his claim was made by several contributors to *Chaos and Complexity*” and that this claim “depends upon taking the Newtonian equations as given and unquestionable—a decision that simply preempts the metaphysical issues from the start” (189, including fn. 8). While I am entirely sympathetic to resisting any preemptive settling of metaphysical questions of determinism, Polkinghorne’s characterization of the views expressed in *Chaos and Complexity* blends physical and mathematical determinism in a deeply misleading way. Chaos theory only requires mathematical determinism. The question is how this affects our *subsequent* attempts to decide whether physical reality is deterministic or indeterminate.
- 31 One critique has gone further. Murphy argued in *Chaos and Complexity* not only that the reasoning of Polkinghorne’s argument is logically flawed but also that the position itself cannot be saved: “Is this move in Polkinghorne’s thought simply an instance of using a bad argument for a position that may well be defensible on other grounds? I think not” (327). This more aggressive, second phase of Murphy’s critique raises an excellent point,

namely, that Polkinghorne's thesis of divine input of active information is difficult to translate into a concrete setting (her amusing example is of Father Murphy trying to save his school in a high-stakes game of pool). This critique deserves an answer but does not clinch Murphy's argument. As far as I can see, nothing can block the hypothesis that our existing laws are approximations to the deep structures of nature.

- 32 For example, see Polkinghorne, "Physical Process, Quantum Events, and Divine Agency," *Quantum Mechanics* 189.
- 33 If entering a contest to predict the future of quantum chaos, I would place my bet on there being no future for it at all. I think it is most likely that chaos occurs nowhere in nature, that it is a misleading artifact of non-linear dynamical systems in mathematics that we find exciting in the same way that the abstract ideas of points and lines and planes are intriguing but occur nowhere in nature. It is a beautiful artifact, to be sure, but chaotic orbits and attractors of chaotic systems have never been used successfully in physical modeling and never can be because of intrinsic limits on testing. We can use non-linear dynamical systems for models but we can never take the chaotic part of those models seriously. Moreover, the lumpiness of nature at the atomic level, and beneath that the quantum level, suggests that we are going to have to tell the incredibly rich and intricate story of complex systems in nature, without recourse to chaos in nature. Saunders makes the latter point about the impossibility of realizing in nature the delicate fractal geometry of chaotic attractors; see *Divine Action and Modern Science*, 186–196, especially 194–195.
- 34 It may be, for example, that deterministic "hidden-variables" interpretations of *quantum mechanics*, such as Bohm's, or modal interpretations, have potential for elaborating a quantum theory of chaos that the standard interpretation does not, which may in turn count as evidence in favor of such interpretations.
- 35 Polkinghorne himself notes the problem with his view of the causal joint, thanking Saunders for the insight. While Polkinghorne provides no solution, he does indicate that he prefers keeping the concept of active information but reformulating it to accommodate the breakdown of the fractal geometry of chaotic attractors, "at least at Heisenberg energy uncertainties"; see *Quantum Mechanics* 189.
- 36 If chaos theory were the deepest inspiration for a reenergized contemporary defense of ontological indeterminism, then the *practical* epistemological limitations suffusing the deterministic mechanics of Newton already would have inspired enthusiasm for ontological indeterminism. It did not work that way with Newton and it should not work that way with chaos theory either.
- 37 See Wildman and Russell, "Chaos: A Mathematical Introduction with Philosophical Reflections," in *Chaos and Complexity*, especially 75–83.
- 38 Within the DAP, this criticism was advanced most notably by Peacocke. Some others shared his intuition on this point. Outside of the DAP, Saunders appears to hold this view; see below for the details.
- 39 In so far as the Uncertainty Principle describes measurement outcomes, it is included in the measurement problem, which is the focus of attention in the analysis below.
- 40 Note, however, that Wegter-McNelly's recent dissertation, *Created Wholeness*, argues that quantum entanglement and non-locality furnish analogies that are useful for articulating a *compatibilist* theory of SDA.
- 41 OPTION #3, that God selects outcome states, seems closely related to OPTION #2, that God adjusts the probabilities of measurement outcomes, with the difference being merely that God assigns a probability of 100% to one possible outcome and 0% to all others. We cannot simply collapse the distinction between the two views, however, because OPTION #2 seems to assume a strong-ontological interpretation of stochastic laws of quantum mechanics as constraining individual quantum measurement events, whereas OPTION #3 is more neutral on the question of how to interpret the stochastic laws of quantum mechanics.
- 42 While this option is not a causal joint proposal like the first four options, and while it

exacerbates the theodicy problem rather bluntly, it is worth pondering. OPTION #5 imagines that God allows all universes to exist but eventually loses interest in the “failures” and pays attention to and answers prayers only in the worlds that prove interesting to God. This is a kind of natural selection of worlds where the outcome is not survival of the fittest but maintaining the divine focus of attention and action. This view focuses on the divine intention rather than causal joints, much as the primary-secondary causation model discussed above focuses on the divine intention with regard to events within one world. While some might well complain about the severity of the theodicy problem inherent in a view that paints God as negligent of parts of creation, I think that this hypothetical theodicy problem is precisely as difficult as the one we actually have in this world. That is, the familiar charge is that God is negligent of certain parts and people of our world, not acting when acting would seem to ease pain, prevent cruelty, and increase justice and love, and educate human beings in much needed ways.

- 43 David Z. Albert gives a clear description of the many-minds view in *Quantum Mechanics and Experience* (Cambridge: Harvard University, 1992). This view offers significant advantages over the ordinary many-worlds interpretation and the price paid is modest (in the context of the alternatives): accepting an unanticipated role for consciousness. A more general framework for understanding this version of the many-minds approach is the consistent histories approach, on which see Chris Clarke, “The Histories Interpretation of Quantum Theory and the Problem of Human/Divine Action,” in *Quantum Mechanics*.
- 44 OPTION #6 deserves serious consideration in the context of the many-minds interpretation in which measurement events do not describe ontological splits but rather the synchronizing of conscious observers and events within an unimaginably complex superposition of states. All possible quantum “worlds” thus coexist within a single superposition and consciousness just happens to be the sort of thing that selects out an intelligible world for observation. On this interpretation, special divine action might be a kind of mind-to-mind influence in which God triggers subtle shifts in our consciousness so that we see a slightly different kaleidoscopic cross-section of the vast superposition that is reality. It may even be possible for observers within the world to modify their own consciousness in such a way as to skip to other world-synchronizations. This view also allows for the possibility that people capable of observing one another could yet see other features of the world differently, which possibility could serve as a speculative framework for articulating the distinction between conventional and ultimate reality that certain Buddhists and Hindus deploy to describe enlightenment and stages along the way to that ultimate state of liberation. If forced to choose among the various options for QSDA, I would choose this one, not because of its interpretation of the quantum formalism but because of the elegant way its rendering of SDA corresponds to long-held beliefs in the world’s great spiritual wisdom traditions.
- 45 I conjecture that it is partly because Murphy does not like these consequences of a descriptive approach to the laws of nature that she speculates about OPTION #4, which ties her theory of SDA decisively to the quantum realm in a way that a descriptive approach to the laws of nature requires, thereby gaining valuable theoretical intelligibility.
- 46 I think it is partly because of this difficulty that both Ellis and Tracy entertain divine action only in some providentially relevant events, rather than in all events. This gives the strongest and least contrived answer to the theological complaint that we cannot have human beings constraining divine freedom to act based solely on whether scientists happen to be gathering quantum statistics.
- 47 See Saunders, *Divine Action and Modern Science*, chapters 5–6. Also, see his “Does God Cheat at Dice? Divine Action and Quantum Possibilities,” *Zygon* 35:3.
- 48 See Saunders, *Divine Action and Modern Science*, 127–148, which is the first part of chapter 6, see also matching parts in “Does God Cheat at Dice?” *Zygon* 35:3.
- 49 Specifically, Saunders’ treatment of divine initiation of quantum measurement events does not discuss the possibility that there may be some stochastic element involved, even outside the continuous spontaneous localization or decoherence theories, which is

the key to making OPTION #1 feasible. He alludes to OPTION #4 in passing but does not analyze it fully and so misses its potential for an incompatibilist account of QSDA; see Saunders, *Divine Action and Modern Science*, 162. In addition, OPTION #5 does not appear in his discussion of the many-worlds approach (159–62), though he does note correctly that compatibilist approaches (of which OPTION #5 could be one if suitably interpreted) have some room to breathe in the many-worlds view. Moreover, he does not consider the strange and possibly indeterministic spaces *between* worlds that result from quantum splitting in the many-minds approach, or the potential for a mind-to-mind causation approach, both of which come into play in OPTION #6.

- 50 See Saunders, *Divine Action and Modern Science*, 110–126, which is the last part of chapter 5.
- 51 See Saunders, *Divine Action and Modern Science*, especially 149–156, but continuing through to the end of chapter 6, and matching parts in the *Zygon* article cited above.
- 52 Russell alludes to it in some places while rejecting it more clearly in others; see below for the specific details of DAP proposals for QSDA.
- 53 See Saunders, *Divine Action and Modern Science*, 155.
- 54 See especially Saunders, *Divine Action and Modern Science*, chapter 3, on “The Laws of Nature and Miracles.” Unfortunately, there is no clear discussion of the scope of stochastic laws of nature governing quantum measurement events (do they apply to ensembles only? to individual events?) in the otherwise helpful treatment of laws of nature in that chapter, yet this distinction seems to be operating silently in the critiques of chapter 6. It is similarly unfortunate that the *reasons* for rejecting the strong-ontological interpretations are not presented clearly in existing DAP publications. However, there is no mystery about this: Ellis, Murphy, Russell, and Tracy are right to believe that the strong-ontological interpretation of stochastic laws instantly destroys their proposals and they are justified in spending their energy arguing for the feasibility of their own views of the laws of nature and SDA.
- 55 See Immanuel Kant, *Critique of Pure Reason* (New York: Macmillan, 1929, 1933). The argument about freedom and determinism is in the Transcendental Dialectic, Book II, Chapter II, Section 9.
- 56 On this, see especially Stoeger’s elegant discussion in “Describing God’s Action in the World in Light of Scientific Knowledge of Reality,” in *Chaos and Complexity*.
- 57 We might think that Polkinghorne’s view counts as a fifth proposal for QSDA. After all, consistency demands that Polkinghorne, rather than arguing against QSDA, should make the same hypothetical proposal in relation to epistemological limits in quantum mechanics that he makes in relation to the epistemological limits of chaos theory, namely, that the relevant laws of nature are downward emergent approximations to a suppler, subtler physical reality within which God acts freely. He approaches this toward the end of his essay, “Physical Process, Quantum Events, and Divine Agency” (*Quantum Mechanics* 188–190) but, even in the context of a magnanimous review of the debate over QSDA, he implies that beginning speculation about SDA from chaos theory and starting from quantum mechanics are competing approaches. I have not yet grasped how this can be so, even if we accept the problematic causal joint proposal of active information changing complex systems through zero-energy alterations of particle trajectories on chaotic attractors. In fact, I would think that Polkinghorne’s approach would apply to every domain of science and every level of reality and every physical law.
- 58 At one point Russell clearly rejects the idea “that God . . . makes measurements on a given system” (*Quantum Mechanics* 296). Yet at the beginning of the same essay, he writes, “[I]f quantum mechanics is interpreted philosophically in terms of ontological indeterminism . . . , one can construct a bottom-up, noninterventionist, objective approach to mediated direct divine action in which God’s indirect acts of general and special providence at the macroscopic level arise in part, at least, from God’s objective direct action at the quantum level both in sustaining the time-development of

elementary processes as governed by the Schrödinger equation and in acting with nature to bring about irreversible interactions referred to as ‘quantum events’” (*Quantum Mechanics* 293). Here and in earlier writings, Russell appears at least to entertain the possibility that God could initiate quantum measurement events. I argued above that this possibility is not as problematic as he seems to conclude.

- 59 In informal discussions surrounding the DAP, but not I think in writing, Murphy has experimented with the idea that God may select outcomes of measurement events in the sense of OPTION #4. She intends this as a thought experiment aimed at resolving a difficulty in the many-worlds interpretation of the quantum mechanics formalism, at the same time as finding in quantum mechanics an ingenious source of support for the idea of special divine action of the pervasive “all events” sort. She points out that a few other people have explored this idea in conversation. While most views asserting universal intentional divine action usually remain vague on the question of the causal joint of action, Murphy’s thought experiment is quite specific and especially interesting because of that. In particular, specifying a causal joint using OPTION #4 offers a way for Murphy to limit God’s action to the quantum level that is less arbitrary than OPTION #3 alone. After all, her descriptive approach to laws of nature is indifferent to the locus in nature of God’s action, apart from independent specification of a quantum-level causal joint. Alternatively, of course, Murphy might prefer to capitalize on the compatibilist tendencies of a descriptive approach to laws of nature. These same considerations apply to Russell’s approach.
- 60 Though this is not my theological territory, recalling the need for an interpreter to maintain credibility, I should state my preferences among these and related options for SDA. To that end, consider the following chain of counterfactuals. If hypothetically forced to accept that God is a personal being who can form intentions and act on them, then I strongly prefer a theory of SDA that affirms miraculous abrogation or suspension of natural laws, owing to its protection of the divine freedom against human pretensions to understand and control it. If further forced to accept the goal of noninterventionism, then I prefer a compatibilist approach for the same reasons. If still further compelled to select from the options available to me within the sphere of objective, incompatibilist, non-interventionist theories, then I would elect the many-minds interpretation of the quantum formalism and OPTION #6 as the mode of divine action. This is because of the flexibility it offers in talking about divine action and because of its consonance both with south Asian and east Asian interpretations of the religious quest for enlightenment and liberation, and with west Asian interpretations of sanctification and divinization.
- 61 In explaining his hypothesis that God acts in indeterminacies at the quantum level, Tracy goes so far as to declare that, “I am *not* saying that God acts *only* through the gaps in the causal order of nature”; see “Particular Providence and the God of the Gaps,” in *Chaos and Complexity* (319; italics in original). In fact, DAP participants usually took an open-ended approach to theorizing about SDA, focusing more on establishing the feasibility of their favored proposal rather than arguing that their view is the only possible one. Tracy was particularly concerned to develop what he calls a “tool box” of options for understanding SDA, within which he thinks his theory of QSDA has a rightful place, along with compatibilist possibilities and even miracles.
- 62 See Murphy, “Divine Action in the Natural Order: Buridan’s Ass and Schrödinger’s Cat,” in *Chaos and Complexity*, especially 340–342, where she writes the line, “To put it crudely, God is the hidden variable” (342).
- 63 See Tracy, “Particular Providence and the God of the Gaps,” in *Chaos and Complexity*. Tracy discusses the issue of the scope of God’s action at the quantum level on 320–322.
- 64 Though Russell’s contribution to *Evolutionary and Molecular Biology* focuses on quantum-level special divine action in genetic mutations, at some places he seems to affirm comprehensive divine action. The extreme example is when Russell writes, “I think that indeterminacies in quantum behavior arise in a much more pervasive way that the term ‘measurement’ suggests. Instead, they arise *constantly*, everywhere and at

all times, in every part of the universe. If so, this claim can increase the theological intelligibility of our faith in general providence of the Triune God who is *everywhere and at all times* at work in and through all of nature" (*Evolutionary and Molecular Biology* 214). Unfortunately, Russell does not elaborate on this suggestion, which seems to expand the notion of quantum event considerably. In Russell's contribution to *Quantum Mechanics*, he clearly sides with Murphy's proposal that God acts in all quantum events and somehow can convey special meaning through some of these events. See "Divine Action and Quantum Mechanics," in *Quantum Mechanics*, especially 316–317. Of course, Russell's proposal also involves God contracting the sphere of special action in the presence of conscious creatures, which we will discuss below.

- 65 DAP publications typically show great care in the use of the word "event." In the following discussion, I use the term "event" in multiple ways. In some cases, the reference is to quantum measurement events, in others to events in the sense of process metaphysics, which are not related to quantum measurement events. In still other cases, I do not specify a metaphysical framework for stabilizing the concept. This usage is merely for the sake of convenience and the context makes clear which sense of "event" is meant.
- 66 See Karl Heim, *The Transformation of the Scientific World* (London: SCM Press, 1953).
- 67 See William G. Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law* (London: Faber and Faber, 1958).
- 68 See Murphy, "Divine Action in the Natural Order," in *Chaos and Complexity*. There Murphy makes the necessary relation between God and quantum events clear when she writes, "My proposal is that God's governance at the quantum level consists in activating or actualizing one or another of the quantum entity's innate powers at particular instants, and that these events are not possible without God's action" (342). Russell clearly rejects the omnideterminism of Pollard; see "Special Providence and Genetic Mutation: a New Defense of Theistic Evolution," in *Evolutionary and Molecular Biology*, where Russell writes, "Though I strongly support Pollard's advance over Heim's formulation of the thesis, I do not support their advocacy of divine determinism" (209).
- 69 See Murphy, *Chaos and Complexity* 342. Murphy's view is strongly reminiscent of Jonathan Edwards' view of God's providence—God determines the world but beautifully, respectfully, and gloriously so. See Murphy, *The Freedom of the Will* (Morgan, Pennsylvania: Soli Deo Gloria Publications, 2003).
- 70 In the *Evolutionary and Molecular Biology* essay, Russell usually refers to biological evolution rather than cosmic history. For example, when he expresses the contraction of divine activity in relation to biological evolution, he writes as follows, "We may think of God as acting in all quantum events in the course of biological evolution until the emergence of organisms capable of even primitive levels of consciousness. Form then on, . . . God may abstain from acting in those quantum events underlying bodily dispositions, thereby allowing the developing levels of consciousness to act out their intentions somatically" (215). I think divine action on a cosmic, indeed universal, scale is implied, however, and not just in biological evolution. This point is clarified in *Quantum Mechanics*.
- 71 Russell is sharply aware of the questions his view invites about God's goodness and believes that a Trinitarian theology of creation, redemption, and consummation is necessary finally to address them.
- 72 See George F. R. Ellis, "Ordinary and Extraordinary Divine Action," in *Chaos and Complexity*, especially 379–382. Ellis's later essays appear to broaden the scope of divine action, though the emphasis remains on intermittent rather than universal action with a focus on human beings; see Ellis, "Quantum Theory and the Macroscopic World," in *Quantum Mechanics*.
- 73 Russell's frank statement of this point is admirable: "I believe the problem of theodicy is stunningly exacerbated by all the proposals, including my own" (*Evolutionary and Molecular Biology* 216).

- 74 See Murphy, "Divine Action in the Natural Order," in *Chaos and Complexity*; and Russell, "Special Providence and Genetic Mutation: a New Defense of Theistic Evolution," in *Evolutionary and Molecular Biology*.
- 75 See Ellis, "Ordinary and Extraordinary Divine Action: The Nexus of Interaction," in *Chaos and Complexity*.
- 76 See Tracy, "Evolution, Divine Action, and the Problem of Evil," in *Evolutionary and Molecular Biology*.
- 77 See Moltmann, "Reflections on Chaos and God's Interaction with the World from a Trinitarian Perspective," in *Chaos and Complexity*; Russell, "Divine Action and Quantum Mechanics," in *Quantum Mechanics*; and Edwards, "The Discovery of Chaos and the Retrieval of the Trinity," in *Chaos and Complexity*.
- 78 I am deeply indebted to the many members of the DAP, and especially to the core group of philosophers and theologians, for my understanding of the issues surrounding the concept of SDA. Their influence suffuses this survey. Any mistakes of logic or interpretation are exclusively my responsibility.